

kilobaud

MICROCOMPUTING^{T.M.}

for business . . . education . . . FUN!

Computer Bulletin Board Systems

Monday, October 29th, 1979, 15:19:52.2 Eastern
CBBS Ver 2.3
Terminal need nulls? Hit control-N while this types:

*** Welcome to CBBS/Boston ***
*** New England's 1st Computerized Bulletin Board System ***
(System up since 12/2/78)

-----> Control characters accepted by this system:

Control-N/DEL Erases last character typed. (And echos it)
Control-C Cancel current printing
Control-K 'Kills' current function, returns to menu
Control-M Send 5 nulls after CR/LF
Control-R Retypes current input line (after DEL)
Control-S Stop/start output (for video terminal)
Control-U Erases current input line

Problems? Try calling the following numbers (617 area code):
Mitch Weirich: 963-3378, 986-3872, 737-4261
Scott Marcus: 986-3878, 963-2792, 733-9793 Rm. 328
Leo Kenen: 698-1642, 262-1128 Ex. 239

Bulletins: Lax.

In This Issue—27 Articles

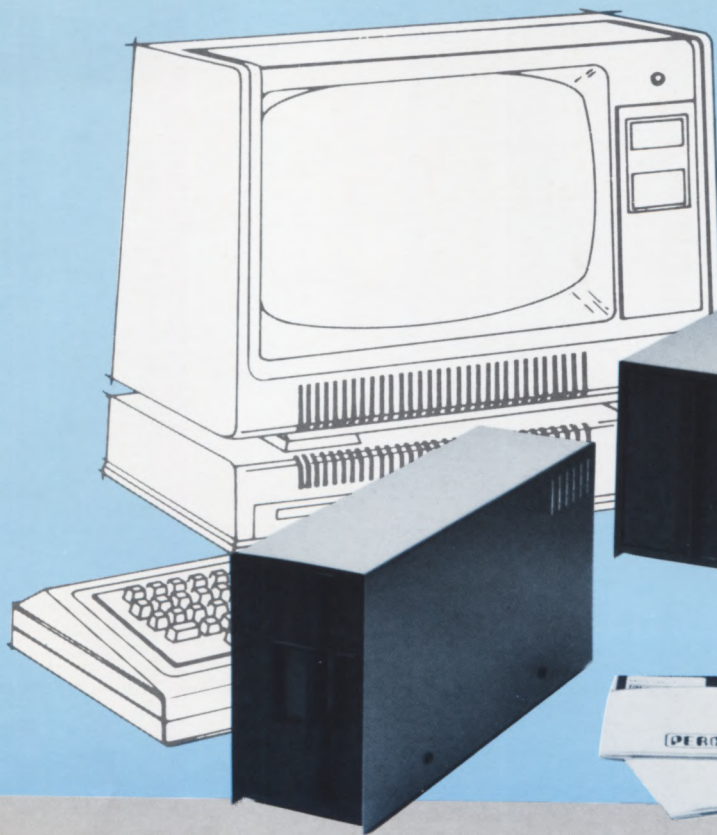
Including:

Dial-Up Directory: New Series on CBBS Activity.....	26
Operator-Oriented Data Base Management—Part 1.....	84
Customized PET: Computer and Disk Drives in a Single Package.....	116
OSI Challenger 1P MF Review.....	140

Complete Table of Contents on page 5.



0



From PERCOM

One-Drive System:

\$399. (40-track) & **\$675.** (77-track)

Two-Drive System:

\$795. (40-track drives) & **\$1350.** (77-track drives)

Three-Drive System:

\$1195. (40-track drives) & **\$2025.** (77-track drives)

Requires Expansion Interface, Level II BASIC & 16K RAM.

Low Cost Add-On Storage for Your TRS-80*. In the Size You Want.

When you're ready for add-on disk storage, we're ready for you. Ready with six mini-disk storage systems — 102K bytes to 591K bytes of additional *on-line* storage for your TRS-80*.

- Choose either 40-track TFD-100™ drives or 77-track TFD-200™ drives.
- One-, two- and three-drive systems immediately available.
- Systems include Percom PATCH PAK #1™, on disk, at no extra charge. PATCH PAK #1™ de-glitches and upgrades TRSDOS* for 40- and 77-track operation.
- TFD-100™ drives accommodate "flippy disks." Store 205K bytes per mini-disk.
- Low prices. A single-drive TFD-100™ costs just \$399. Price includes PATCH PAK #1™ disk.
- Enclosures are finished in system-compatible "Tandy-silver" enamel.

Whether you need a single, 40-track TFD-100™ add-on or a three-drive add-on with 77-track TFD-200™s, you get more data storage for less money from Percom.

Our TFD-100™ drive, for example, lets you store 102.4K bytes of data on one side of a disk — compared to 80K bytes on a TRS-80* mini-disk drive — and 102.4K bytes on the other side, too. Something you can't do with a TRS-80* drive. That's almost 205K bytes per mini-disk.

And the TFD-200™ drives provide 197K bytes of on-line storage per drive

— 197K, 394K and 591K bytes for one-, two and three-drive systems.

PATCH PAK #1™, our upgrade program for your TRSDOS*, not only extends TRSDOS* to accommodate 40- and 77-track drives, it enhances TRSDOS* in other ways as well. PATCH PAK #1™ is supplied with each drive system at no additional charge.

The reason you get more for less from Percom is simple. Peripherals are not a sideline at Percom. Selling disk systems and other peripherals is our main business — the reason you get more engineering, more reliability and more back up support for less money.

In the Product Development Queue . . . a *printer interface* for using your TRS-80* with any serial printer, and . . . the *Electric Crayon*™ to map your computer memory onto your color TV screen — for games, animated shows, business displays, graphs, etc. Coming PDQ!

™ TFD-100, TFD-200, PATCH PAK and Electric Crayon are trademarks of PERCOM DATA COMPANY.

*TRS-80 and TRSDOS are trademarks of Tandy Corporation and Radio Shack which have no relationship to PERCOM DATA COMPANY.

PERCOM

PERCOM DATA COMPANY, INC.
211 N. KIRBY • GARLAND, TX. • 75042

✓P7

To order add-on mini-disk storage for your TRS-80*, or request additional literature, call Percom's toll-free number: 1-800-527-1592. For detailed Technical information call (214) 272-3421.

Orders may be paid by check or money order, or charged to Visa or Master Charge credit accounts. Texas residents must add 5% sales tax.

Percom 'peripherals for personal computing'

SuperBrain™



The Honor Graduate

There's been a lot of talk lately about intelligent terminals with small systems capability. And, it's always the same. The systems which make the grade in performance usually flunk the test in price. At least that was the case until the SuperBrain graduated with the highest PPR (Price/Performance Ratio) in the history of the industry.

For less than \$3,000*, SuperBrain users get exceptional performance for just a fraction of what they'd expect to pay. Standard features include: two dual-density mini-floppies with 320K bytes of disk storage, up to 64K of RAM to handle even the most sophisticated programs, a CP/M Disk Operating System with a high-powered text editor, as-

sembler and debugger. And, with SuperBrain's S-100 bus adapter, you can even add a 10 megabyte disk!

More than an intelligent terminal, the SuperBrain outperforms many other systems costing three to five times as much. Endowed with a hefty amount of available software (BASIC, FORTRAN, COBOL), the SuperBrain is ready to take on your toughest assignment. You name it! General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing . . . the SuperBrain handles all of them with ease.

Your operators will praise the SuperBrain's good looks. A full ASCII keyboard with a numeric keypad and function keys. A non-glare, dynamically focused, twelve inch screen. All in an attractive desktop unit weighing less than a standard

office typewriter. Sophisticated users will acclaim SuperBrain's twin Z-80 processors which transfer data to the screen at 38 kilobaud! Interfacing a printer or modem is no problem using SuperBrain's RS-232C communications port. But best of all, you won't need a PhD in computer repair to maintain the SuperBrain. Its single board design makes servicing a snap!

So don't be fooled by all the freshman students in the small systems business. Insist on this year's honor graduate . . . the SuperBrain.

 **INTERTEC
DATA
SYSTEMS®**

2300 Broad River Road, Columbia, SC 29210
(803) 798-9100 TWX: 810-666-2115

*Quantity one. Dealer inquiries invited.

MORE CAPABILITIES THAN ANY OTHER PERSONAL COMPUTER UNDER \$1,000*

Compare the built-in features of the ATARI® 800™ with other leading personal computers. Whether you program it yourself or use pre-programmed cartridges or cassettes, the ATARI 800 gives you more for your money.

Run your own programs? Easy. Just plug in the 8K BASIC or optional Assembler language cartridge, and go. They're ROM based. That means more RAM for your programs.

Also included with the ATARI 800 is an internal speaker and four separate sound channels, FCC approval, a built-in RF modulator, the ATARI 410™ Program Recorder and a high speed serial I/O.

Peripherals? Add up to 48K of user installable RAM. Or up to four individually accessible floppies.

A high-speed printer. And more to come.

Graphics programs? No problem. The ATARI 800 offers 128 color variations: 16 colors in 8 luminance levels. Plus 29 keystroke graphics symbols and 8 graphics modes. All controlled from a 57 character ASCII keyboard. With upper and lower case.

Or, program it our way. There are exciting programs available and many more on the way for the ATARI 800. Business programs. Home Management programs. Entertainment. And with the 410 audio/digital recorder, you can add Atari's unique Talk & Teach™ Educational System cassettes.

Your way or our way, you'll find that the ATARI 800 is probably the most powerful computer that \$999.99* can buy.

And with that power, you get dependability. Dependability built into Atari's custom designed and fully-tested LSI circuitry and lower component count, (less components, less chance for failure).

But if anything ever does go wrong, you'll find a complete network of computer-connected Atari service facilities waiting for you throughout the country.

Make your own comparison. Hands on. Anywhere computers are sold. Or, send for a free chart that compares the features of the ATARI 800 to other leading fully-programmable computers.

*Suggested retail price \$999.99, includes computer console, program recorder and BASIC language cartridge.



ATARI®
PERSONAL COMPUTER SYSTEMS

1265 Borregas Ave., Dept. C, Sunnyvale, California 94086. Call toll-free 800-538-8547
(In California 800-672-1404) for the name of your nearest Atari retailer.

© Atari 1979

A Warner Communications Company

contents: jan. '80

ARTICLES

- 26 **Dial-up Directory** Start of a series on computer bulletin board services. *Frank J. Derfler, Jr.*
- 28 **Tiny Dual-Trace Oscilloscope** Non-Linear Systems' Model MS215. *Nat Wadsworth*
- 32 **Chinese Character Generation** Use the Sorcerer's graphics keys. *Timothy Huang*
- 36 **Using Five-Level Teleprinters with a TRS-80** These printers abound. *Brian Bateman*
- 50 **A Video Board from Ithaca Intersystems** This article takes a look at it. *Ernie Brooner*
- 52 **Route 66 Modem** Exchange information with this economical design. *Frank J. Derfler, Jr.*
- 56 **The SWTP Computer System** Installment number 8 looks at the 6809. *Peter A. Stark*
- 66 **Outer Limits Addition** Overcome programming limitations. *Allan S. Joffe*
- 70 **TM990/189 University Board** New microprocessor from Texas Instruments. *John Caulfield*
- 74 **Not-So-Fast Renumberer for OSI BASIC** For neat and tidy listings. *John W. Aughey*
- 78 **Visions of Sacks of Silver Dollars** Blackjack-strategy tutor. *Thomas W. Glaser*
- 84 **☞ Data Base Management System** First in 3-part series describes the system. *Joel Shapiro*
- 90 **Relocator for North Star BASIC** Find all the applications. *Lance E. Rose*
- 94 **Synertek's SYM-1** The newly named VIM is still versatile. *Bonaventura Paturzo*
- 98 **Converting Selectric Keyboards from BCD to Correspondence Code** (part 2). *Robert M. Weil*
- 102 **Plucking Programs from Thin Air** An unusual source of programs. *John J. Glidewell*
- 110 **"Core" and More for Your Apple** Accessories for serious computing. *Leslie R. Schmeltz*
- 116 **The Metamorphosis of a "Custom" PET** Portability in a disk-based PET. *Robert Freeman*
- 126 **Darkroom Master** Unleash your PET in the darkroom. *Jeff Knapp*
- 134 **TRS-80 Printer Interfaces** Serial and parallel designs. *Rod Hallen*
- 140 **The OSI Challenger 1P MF** A good minifloppy for the beginner. *Charles Curley*
- 144 **A Heath H8 Disassembler** A follow-up to "CONOPS." *Chesney E. Twombly*
- 150 **Software Clock for the 6800** Instant access to correct date and time—in ASCII. *Richard R. Parry*
- 160 **Converting a Bargain TV to a Video Monitor** Use the Lancaster method. *Stephen E. Bach*
- 164 **Load Your SWTP at 4800 + Baud** With JPC Products' cassette interface. *Jerry L. Hunt*
- 172 **Hex and ASCII** Do it with an ASCII keyboard. *D. E. Price*
- 180 **Interrupting BASIC** You'll need a source listing and this article. *Willits, Wiser*

DEPARTMENTS

Publisher's Remarks — 6
 Output from Instant Software, Inc. — 7
 Books — 8
 PET-pourri — 14
 Computer Clinic — 16
 Club Notes — 16

Letters — 17
 New Products — 20
 Classifieds — 170
 Corrections — 170
 Dealer Directory — 171
 New Software — 188

Cover: This month's cover shows CBBS Boston (617-963-8310) dialed up and displayed on a Heath H19. (Photo by Reese Fowler, ISI staff)

micro info

☞ This symbol next to a title in the table of contents indicates that the article is a business-application article.

Manuscripts

Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a self-addressed, stamped envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. All contributions should be directed to the *Microcomputing* editorial offices. "How to Write for *Microcomputing*" guidelines are available upon request.

Editorial Offices:

Pine Street
 Peterborough NH 03458
 Phone: 603-924-3873, 924-3874

Advertising Offices:

Pine Street
 Peterborough NH 03458
 Phone: 603-924-7138, 924-7139

Circulation Offices:

Pine Street
 Peterborough NH 03458
 Phone: 603-924-7296

To subscribe, renew or change an address:

Write to *Microcomputing*, Subscription Department, PO Box 997, Farmingdale NY 11737. For renewals and changes of address, include the address label from your most recent issue of *Microcomputing*. For gift subscriptions, include your name and address as well as those of gift recipients. Postmaster: Send form #3579 to *Microcomputing*, Subscription Services, PO Box 997, Farmingdale NY 11737.

Subscription problem or question:

Write to *Microcomputing*, Subscription Department, PO Box 997, Farmingdale NY 11737. Please include an address label.

Kilobaud *Microcomputing* (ISSN 0192-4575) is published monthly by 1001001, Inc., Pine St., Peterborough NH 03458. Subscription rates in U.S. are \$18 for one year and \$45 for three years. In Canada: \$20 for one year and \$51 for three years. In Europe, send 89.-DM in Eurocheque or send credit card information to: Monika Nedela, Markstr. 3, D-7778 Markdorf, W. Germany. South African Distributor: KB Microcomputing, PO Box 782815, Sandton, South Africa 2146. Australia: For subscriptions write — Katherine Thirkell, Sontron Instruments, 17 Arawatta St., Carnegie, Vic. 3163 Australia. All other foreign subscriptions are \$23—one year only (surface mail). Second-class postage paid at Peterborough NH 03458 and at additional mailing offices. Phone: 603-924-3873. Entire contents copyright 1979 by 1001001, Inc. No part of this publication may be reprinted or otherwise reproduced without written permission from the publisher.

PUBLISHER'S REMARKS

Wayne Green

用之基本能
型、小型特
工業實用技
生產與推廣
執行的方針
得電腦系統
術。同時研
製作各階段
供應市場。
託作特殊系
，除能建立
成訓練技術
展電腦硬體
援國內電腦

It takes an 18 by 22 dot matrix to print these Chinese characters. It takes a lot of time to put the characters together and a long time to print them. That the Chinese have been able to cope with their incredible written language with computers is a testimony to man's ability to adapt to almost anything.



Many of the keys have up to five different characters or character components, which can be put together with others to make the finished Chinese characters. The 10,000 characters that can be generated with this system constitute a minimum language, since most Chinese use four to eight times that number of characters when writing.

Next Year: Asia!

Well, you missed out on a big one. The IEEE sponsored a trip to Asia in October. It was a hum-dinger. Over 100 people went to consumer electronics shows in Seoul, Osaka, Teipei and Hong Kong. Some went to look for products to sell. Some went with products to be sold in these rapidly growing markets. Some went for the fun of it. No one was disappointed.

The trip, which at well under \$2000 for three weeks in several countries was one of the modern-day bargains, included all transportation, hotels and more meals than you might want.

If you sell anything, the cornucopia of products on display at these consumer electronics shows will fire your imagination. And if they don't already have what you want, you can bet that they will be happy to gear up and produce what you need in a few days.

Korea and Taiwan, in particular, are almost desperate for trade and are ready to buy your products or make them for you... with government assistance. If you have anything that might sell in China, go to Hong Kong, the great entryway to China.

Sherry and I are planning to take this tour again next year, and I hope that some of you will join us in the fun. We'll set up visits to computer stores and manufacturers and talk with computer clubs.

I'll have more information on

this trip in 1980; for now, mark off the first three weeks of October and plan to do some fantastic traveling during this time.

China Has a Big Problem

My recent visit to both Taiwan (Republic of China) and Hong Kong (essentially an adjunct to mainland China) put me in touch with the latest Chinese microcomputer technology. The Chinese have a problem. Their language is incompatible with computers.

I watched two different Chinese character-generator terminals at work. One had hundreds of keys, each with up to five different characters on it, and many characters required the use of two or more keys. This system could generate 10,000 different characters... a sort of minimum for writing in the language. Another had a system that built up the characters with as many as seven parts before displaying the complete character... again with a 10,000-character library.

The basic problem is that each Chinese character is like one of our words, and the Chinese have no phonetic spelling system. The Japanese do have a phonetic system, called Kana, so they are able to cope with computers. I understand that Singapore, which is 98 percent Chinese, has decreed that the official language of the coun-

try will be English within 20 years. It is a little late to invent a Chinese phonetic language, so perhaps the writing of thousands of years should be set aside and English selected for China for the future. This would not be easy.

As China falls behind the rest of the world in computer use, I think the pressure will be on for some solution to the problem. Microcomputers will quickly aggravate this problem by making even small businesses and education dependent on computers. The Chinese are good businessmen, so I think they will see the poster on the wall and realize that something is going to have to give. As deeply as they are rooted in tradition, tradition will have to give way to technology if China is going to be competitive in the future.

Few people are yet aware of the incredible changes that microcomputers are going to make in the world. Those who see what is happening realize that the world will never be the same. In high-technology countries, computers will make it possible for people to be freed from repetitive tasks such as secretarial work, filing and record keeping. Emerging nations will depend on microcomputers for business and education as much as high-technology countries.

Where does this leave a country with no phonetic language? A simple and computer-compatible language is required to cope with the coming changes. Thus I think



This Chinese character generator has over 200 keys used to build up a library of over 10,000 different characters.

that China will have to grit its collective teeth and opt for English as a way to accommodate computers.

Recognizing this situation, Instant Software is shipping programs in English to both Taiwan and Hong Kong. The programs being sent to Japan are in both English and Kana. Those going to Korea are largely being translated into Korean.

Practice the Preaching

Can a magazine have too much circulation? I think so, and I'll

tell you why. The main problem when circulation increases is that advertising costs also have to go up by the same percentage. When the ad rates go up, smaller firms no longer can afford to run ads. This not only discourages new small firms, it also makes a magazine less interesting. These new firms often have the most progressive products and the best bargains.

With *Kilobaud Microcomputing's* circulation reaching 100,000, I faced a serious situation. Ad rates, which are based on so many dollars per thousand readers, would have to be increased. One look at the advertising barrenness of high-circula-

tion magazines convinced me that I didn't want to go that route.

The increase in sales and interest in the TRS-80 system made it obvious that TRS-80 information would eventually push out the coverage of other systems in *Microcomputing*. It was also obvious that this would quickly increase the circulation of the magazine to where it would start to freeze out smaller firms. When I started *Byte* my overall plan was for us to build magazines up to a maximum circulation of around 100,000 and then split them according to separate interests to keep down further growth. The easiest split for *Microcomputing* was to start *80 Microcomputing*.

OUTPUT FROM ISI

Sherry Smythe

ISI Sales Reps

You'll be reading more about the developing Asian distribution of Instant Software elsewhere, but the nub of it is that software is now being exported to Japan and will eventually be available in about 100 computer stores there in both English and Japanese versions.

Meanwhile, distribution in the U.S. has been stepped up. More computer stores are joining the Instant Software team; we are projecting over 500 stores associated with ISI by the end of 1979. Dozens of enthusiastic people have been applying for the sales rep jobs, and a network of reps is being established.

Because the key to the success of any publisher lies primarily in marketing, ISI has set up the first rep organization in the microcomputer field. These sales reps go into every computer outlet and make sure that the outlets are aware of the benefits Instant Software will bring.

ISI is also going into every country in the world where microcomputers are sold and making sure that ISI program packages are on hand to help these sales. This brings Instant Software to a world market of well over 600 million people. We have translators setting up our programs in more languages and supporting more systems.

We need more associate editors to help convert our program packages for the Apple and

Heath systems. Some of the programs call for extensive graphics conversions, which will be compensated by increased royalties for this work. If you have both a TRS-80 and an Apple, this might be a way to make a nice additional income, one that will come in every month in royalties. Write to me about this.

As I look over the competition, I believe that both our quantity and quality are now tops in the field. As a programmer, your royalties are going to be a direct function of the ability of your publisher to sell, so the bigger the firm you go with, the more sales you can expect. The problem here is that the competition for publication of a specific type of program will be tougher with a large publisher such as ISI, and you could find yourself coming in second to some other programmer. There is much to be said for getting busy—now—and not waiting.

Smaller firms that have tried to market program packages have contacted us to simplify their sales and distribution problems. They have had difficulties with credit, advertising, duplication, packaging, printing documentation and unwillingness of many dealers to try to do business with a hundred small firms instead of one large one. By letting ISI do the marketing, smaller firms can concentrate on writing and developing program packages rather than involving themselves with the endless miseries of marketing and financing.

Warning

If you are a TRS-80 user and have a CTR-80 cassette recorder, be sure to have Radio Shack do a free fix on your recorder so it will not zap your program tapes. We get back a few tapes each month that have been zapped this way, and we replace them for a \$1 service charge. But this is a big pain for any computerist, and the recorder should be modified so it will not accidentally erase parts of the program.

One hint: If you do manage to ruin part of a program, check to see if there is a second recording of the program further on down the tape. Most ISI program cassettes have two dumps of the program . . . just in case one gets botched in some way.

Questions and Answers

Some phone callers have wondered why Instant Software doesn't answer questions that have been written in. We do answer, but many programmers include questions with submitted programs. That's a sure way to not get answers. If there are questions, use a separate sheet of paper and envelope so the questions won't go into the program files. Better, address questions to Editor-in-Chief Paul Weiner, Instant Software, Peterborough NH 03458.

Kilobaud

MICROCOMPUTING™

PUBLISHER/EDITOR

Wayne Green

EXECUTIVE VICE PRESIDENT

Sherry Smythe

CORPORATE CONTROLLER

O. Alan Thulander

ASSISTANT PUBLISHER/EDITOR

Jeffrey D. DeTray

MANAGING EDITOR

John Barry

EDITORIAL ASSISTANTS

Dennis Brissom

Susan Gross

ADMINISTRATIVE ASSISTANT

Dotty Gibson

PRODUCTION DEPARTMENT

MANAGER:

Noel R. Self

ASSISTANT MANAGER:

Robin M. Sloan

STAFF:

Steve Baldwin

Robert Drew

James H. Gray II

Bruce Hedin

Carl Jackson

Ken Jackson

Dion Owens

Nancy Salmon

Patrice Scribner

John W. White

TYPESETTING

Barbara J. Latti

Sara Bedell

Rhonda Clapper

Sandie Gunseth

Mary Kinzel

PHOTOGRAPHY

W. H. Heydolph

Tedd Cluff

Terrie Anderson

PROJECTS EDITOR

Jim Perry

BOOK EDITORS

Peter Perin

Chris Brown

Emily A. Gibbs

ASSOCIATE EDITORS

Frank J. Derfler, Jr.

Rod Hallen

Peter Stark

Sherm Wantz

BOOKKEEPER

Knud E. M. Keller

MARKETING/CIRCULATION

Harold L. Stephens

Donna Taylor

BULK SALES MGR.

Judy Waterman

CIRCULATION

Pauline Johnstone

COMPUTER PROGRAMMING

Richard Dykema

EUROPEAN MARKETING DIR.

Reinhard Nedela

AUSTRALIAN DISTRIBUTOR

Katherine Thirkell

ADVERTISING

Aline Coutu, Mgr.

Marcia Stone

Penny Brooks

Nancy Ciampa

Cheryl McDaniel

Jerry Merrifield

Lori Mugford

Kevin Rushalko

Carol Symonowicz

BOOK REVIEWS

Payroll with Cost Accounting in CBASIC

Osborne/McGraw-Hill

Berkeley CA

Looseleaf with binding

364 pages, \$15(?)

I indicated the price of the book as "\$15(?)" because I wrote the review using an advance copy, prior to publication of the book; hence, I did not know what the exact retail price would be.

The Osborne series of business-program books forms an integrated accounting system composed of three parts: payroll with cost accounting, accounts payable/receivable and general ledger. Each part can be used independently or in conjunction with the others. In this respect the Osborne system is similar to several competing systems. It is dissimilar in another respect: price. The retail prices of comparable products are typically in the \$700 range, while the end-user cost for one part of the Osborne system is \$15 for the book and another \$100 or so for a disk containing the programs.

The first versions of the business-program books used Wang BASIC. The new versions—of which *Payroll* is the first—use CBASIC-2, which is widely available for 8080- and Z-80-based microcomputers. The CBASIC-2 versions are functionally identical to the Wang BASIC versions. To run the programs under the CP/M operating system and the CBASIC-2 compiler, the microcomputer system should have 40K memory, a video terminal with programmable cursor control and a 132-column printer with form-feed (or "top-of-page") control. Substantial disk capacity should be available.

Simplicity is a key feature of the books at the end-user level. Functions are selected from a menu that the programs display on the video terminal. *Payroll* includes 34 primary functions, ranging from file maintenance to report generation. Eight of the functions support the job cost accounting subsystem. Each of the 34 functions is actually a separate program or a separate set of programs. A controlling program—the "menu" program—allows

the user to select a function from the menu display; the program for the selected function is then loaded automatically from disk.

Payroll with Cost Accounting—CBASIC (i.e., the book) is divided into eight chapters. The first provides an overview of the system, followed by a list of available functions. Chapter two, "Data Files," explains the file-accessing techniques used. It lists and describes the data files the payroll system maintains. This chapter also includes two useful tables: a cross-reference of which programs use which files and a detailed layout plan of the files.

Chapter three is the "Management Guide." It describes the procedures normally required for successful use of the system. Some procedures are usually performed daily, others monthly, others quarterly and so on. Also described in this chapter are techniques to prevent and recover operator errors.

Chapter four, the "User's Manual," is a 150-page book-within-a-book. Its half-dozen pages of introductory material are followed by detailed instructions for the 34 functions. Each function receives several pages of consideration, including textual discussion, sample program displays and/or printouts and a user flowchart. As with the other sections of the volume, the text of the User's Manual is consistently lucid. General readability is improved by a boldface/lightface format that appears in many other Osborne publications.

Chapter five describes the hardware and software needed for direct use of the CBASIC-2 versions. For those who plan to convert the programs to another dialect of BASIC—or even another language—the chapter next covers the elements of CBASIC-2 that are substantially different from more conventional, interpreted BASICs. Chapter six, "Changing This Payroll," provides useful instructions on how to customize the system.

Chapter seven covers miscellaneous information relating to setup and maintenance of the payroll system: details on common subroutines, disk space mapping, data file creation and CRT mask manipulation. The latter represents a feature of the Osborne systems: display masks

are defined centrally and may be modified using a program called CRTFM. The section on CRT mask files is a bit cursory.

The final chapter contains the source listings of the 39 programs and ten common subroutines that form *Payroll*. The listings are large enough to read. They are also amply commented with remark statements. Another documentation aid is the frequent use of descriptive variable names, such as DEDUCTION.AMOUNT and ANNUAL.PAY.

A small question arises: how do you transfer 300K+ of listings from the printed page to a computer? You could key them in, perhaps, but that wouldn't be practical. The solution is to make the programs available on disk, which Osborne has done.

The company sells 8-inch, single-density disks containing source listings (.BAS suffix) of the programs. The disks cost \$250 per part; payroll, accounts payable/receivable and general ledger are three separate parts. Purchasers of the disks may modify and copy them for resale without royalty. That is, Osborne has defined their copyright to prohibit only human-readable (i.e., printed) reproductions of the programs. (Presumably, you are permitted to generate hard-copy listings for local use, however.)

Other companies have converted the programs to run on other microcomputers and mini-computers. Osborne maintains a referral list for customers who want to obtain conversions for their systems. At this writing, nearly 20 computers are supported by recognized converters. Each converter determines his own price.

The Osborne business-program books seem ideal for the emerging micro-based business system market. Even in comparison to the few competent software packages available today, the Osborne programs are good. And while the books are intended for the implementor who wants to use the published programs, they also form worthwhile models and references for the programmer who wants to develop his own business software. In either case, the Osborne series should prove invaluable.

David Price
Midlothian VA

BASIC with Style

Wagin and Ledgard

Hayden Book Co., Inc.

Rochelle Park NJ

1978, \$5.95

BASIC with Style is one of a series of "programming proverbs" books. Other volumes have been published for FORTRAN, COBOL and ALGOL/PL/1. The aim of all of the books in the series is the same: to present and explain a small set of nineteen rules for writing well-structured programs.

BASIC with Style assumes that the reader knows the rules for writing syntactically correct BASIC programs. The point of the book is to teach you how to go from programs that follow the rules of BASIC grammar to programs that are good from the point of view of BASIC style. Style does not mean attractive; it means well thought out and easy to read, check and modify . . . top-down structured programming.

Structured programming is often presented as complicated and executable only in special languages (such as PASCAL or ALGOL) that are not usually available—especially on home computers. True, it is easier to write structured programs in PASCAL, but it can be done in BASIC almost as well. This book shows how. The basic rules presented here are simple: think before you write, write in manageable chunks, comment as you go and check your work. All this is common sense; the book shows how to apply it.

Only on two points do the authors give advice that may not be applicable to personal computing. The first is their heavy stress on desk-checking syntax. This may be important in a batch environment where you wait half a day between the time you submit a program and the time you get it back; in an interactive context, it is much faster to run the program and let your BASIC tell you when you have mistyped something. Computers are much better at routine work than are people!

The second area where the book departs from a personal-computing context is in discussing the establishment of pro-

gramming standards. This is something a programming group does; an individual can set and modify his or her own practices as experience dictates.

In conclusion, *BASIC with Style* is a useful book for someone who has already learned BASIC and who wants to learn how to write programs according to modern ideas of effective programming. Programs written following the recommendations in this book will be easier to write, more likely to work and easier to modify. They will also take up more memory, but that is often a small price to pay for a working program.

John A. Lehman
Ann Arbor MI

The Elements of Programming Style

Kernighan and Plauger
McGraw-Hill, New York, 1974
141 pages, softcover

If you intend to write programs to be used by other people, then you should read this book. If you expect to become a professional programmer, this book is mandatory reading.

The Elements of Programming Style is definitely not an ordinary "how to program" book. In my opinion, there are three distinct differences between this and most programming books.

The first is Kernighan and Plauger's primary concern with the "human factors" of programming: how to write programs that are easier for people to read, understand and use. The authors make the point that if enough attention is devoted to the human requirements in programs, the machine requirements will take care of themselves. To paraphrase the conclusion of chapter 1: The problem with programs people have trouble understanding is not that computers have similar trouble, but that the programs often don't do what they are meant to do.

Addressing the problem of having a program do what it is intended to do, Kernighan and Plauger present 63 "points of style." These range from the generally familiar—"parenthesize to avoid ambiguity," "make sure comments and code agree," "choose a data representation which makes the program simple," "watch out for off-by-one errors"—to the more esoteric—

"10.0 times 0.1 is hardly ever 1.0." If any of these rules does not seem obvious, don't worry. As you read the book, every rule is derived from examples that clearly show its application.

The second difference between *Elements of Programming Style* and other programming books is the examples. Every example in this book is a program (or program segment) taken from a published programming textbook. Kernighan and Plauger then improve these programs using the points of style they wish to illustrate.

The authors mention two reasons why they use published programs for their examples: (1) to show the application of the "points of style" to already existing programs rather than present the reader with contrived examples and (2) to learn to write better programs by improving old programs.

This means learning to read critically and to rewrite programs carefully. These examples will convince good-to-average programmers that this book is not just a rehash of known information. I can think of no better book to teach the underlying principles of program development to beginning programmers.

The third difference about this book is a different method of publication. In their examples, Kernighan and Plauger uncover numerous errors, not just in style, but obvious programming errors such as typographical mistakes, misspelled identifiers and transposed statements that would have made it impossible to run the program as given. They also uncover plenty of not-so-obvious errors that should have been caught during testing. In order not to have the same kind of mistakes show up in their book, the authors typeset the book themselves, using a computer-driven typesetting program that allowed them to test the examples directly from the text. While Kernighan and Plauger make no claim that their versions of the programs are "best" in any sense, there is some assurance that they will work as presented.

Elements of Programming Style provides convincing proof that writing programs that are easy to debug, work properly with no hidden failure modes and are easy to use does not have to be a black art. Instead it is possible for anyone who will learn and apply a few basic principles of programming style. The authors also prove that it is possible to make these

"better" programs available to a wide audience, with some assurance that the programs are usable as presented. I can testify that a conscientious application of even a few of the principles outlined in this book will make you a better programmer. It is my belief that when a majority of practicing programmers have read this book, the software industry will have taken a long step toward maturity.

Jack W. Reeves
League City TX

Z-80 & 8080 Assembly Language Programming

Kathe Spracklen
Hayden Book Co., Inc.
Rochelle Park NJ
Softbound, 165 pp., \$7.95

Assembly-language programming is an exciting pastime. Therefore, I always keep my eye out for new books on the subject. I am especially interested in Z-80 programming since I recently swapped my Sol for a Cromemco Z-2. I sent for a copy of Spracklen's book hoping to capitalize on my 8080 experience and move painlessly up to the Z-80.

I've accomplished my goal, but not without learning a few things that might be of interest to prospective purchasers of this text.

The introduction to *Z-80 & 8080 Assembly Language Programming* states that it is intended for people who have some experience in a high-level language such as BASIC or FORTRAN and want to tackle assembly-language programming. It also says it will provide just about everything the applications programmer needs to know to get the most out of his machine. Let's see how close to those designs the book comes.

Starting with simple decimal-binary-hex mathematics and then moving into a discussion of bits and bytes and CPU flags, the author is beginning at the beginning. To strengthen the learning process, each chapter ends with a series of exercises whose answers can be found in the appendices.

Next come variables, and we're deeply involved in our subject, especially novices with no previous assembly-language programming experience. Unfortunately, at this point, we're only 14 pages into the book. I started feeling early that we were rushing things. Even with my background I'd have

liked a little more explanation.

Much of the book discusses the various 8080/Z-80 instructions yet minimizes how to put them to use or even why you'd want to use them. Most of the "how" involves exercises that present programming problems and then use commented source listings as the answer. The information is all there, but I feel that the beginner will have trouble relating the text and the listings to the actual programming task.

In all examples where it is appropriate, 8080, Zilog Z-80 and TDL Z-80 mnemonics are given. In many cases, 8080 programming equivalents to the more powerful Z-80 instructions are listed.

The operation of all the instructions discussed is displayed diagrammatically using symbols I am sure are well known to professional programmers. These symbols are not as well known to computer hobbyists because they do not appear on most keyboards. Symbols such as \neq , \leq and \geq would have been more familiar to most of us if presented as $<>$, $<=$ and $>=$. Several others, which I still don't know the meaning of, are used.

The final chapter concerns saving the programmer's time and saving processor time. Both are laudable goals. Structured programming is presented as the solution to the first problem, and reducing the number of processor cycles required to complete a task is advocated for the second. I agree in both cases but would have liked more discussion. As with the rest of the book, I felt that we were skimming along.

Am I being too critical? I tried to take the author's word that this text was intended for the person without any previous assembly-language programming experience. However, I don't think it is possible to teach a subject as complex as Z-80 programming from scratch in 102 pages. Add 21 pages to list the 8080/Z-80 instruction sets and 43 pages of exercise answers, and you get 165 pages.

Z-80 & 8080 Assembly Language Programming claims to be ideal for self-study and for schools. I agree that everything necessary to program a Z-80 microprocessor in assembly language is provided, and the book was worthwhile. I just think the material is covered too quickly and without enough practical application.

Rod Hallen
Tombstone AZ

OHIO SCIENTIFIC'S SMALL SYSTEMS JOURNAL

Introduction

In this month's issue we will be concluding the multi-part series on Ohio Scientific's information management system, OS-DMS. Our objective in this issue is to give the reader a brief description of the final three information management systems: Inventory, Quotation/Estimation, and Testing/Tutoring which have not been shown in our previous articles. Like the past articles, this issue also contains several reports which were generated by these systems so that the reader might better understand the purpose of the system.

OS-DMS QUOTATION/ESTIMATION SYSTEM

The OS-DMS Quotation/Estimation Package, like the other OS-DMS modules, utilizes OS-DMS compatible master files and is specifically designed for a non-computer-oriented user. The system is designed to aid the businessman whose activities involve providing estimates or quotations as a part of his normal business proceedings. It provides a quick and easy method of making these calculations with the ability to generate hard copies for further reference and customer presentation. The package also acts as a prompter by displaying each factor that was previously defined, reminding the user to consider each factor every time the program is run.

Because the user establishes each file and record, he can perform either general or specific estimates. In the case of general estimates, the user would create a file containing all of his inventory and other items, tangible or intangible, needing to be considered. Then, anytime a calculation would be needed, the user would be prompted by each item that was previously entered. That is, each item would appear on the screen before him for confirmation of use in that particular operation.

For specific estimates, the user would create a file containing only the items necessary to perform that particular task. For example, a construction company would create files for building, landscaping, or demolition estimates. Or, the files may be broken down into even more specific functions such as building houses, building garages or building barns. These files may contain such things as materials, carpenter's wages, bricklayer's wages, operating expenses, transportation expenses, fees for permits and overhead expenses.

Below is a copy of the Estimation System Menu.

```
OS-DMS ESTIMATION
      Functions
(1)  CREATE NEW ESTIMATION FILE
(2)  EDIT ESTIMATION FILE
(3)  PERFORM ESTIMATION
(4)  ESTIMATION CHANGE AND/OR REPORT
(98) OS-DMS FILE DIRECTORY
(99) EXIT
```

OS-DMS ESTIMATION SYSTEM OVERVIEW

The following is a short key to the programs on the menu.

CREATE NEW ESTIMATION FILE

This program allows the user to create new estimation files. The user specifies file names, passwords, and the number of records per file. All other specifications, such as the number of fields, the name of each field, and the maximum length of each field, are predefined. The system then creates and initializes the estimation file automatically.

EDIT ESTIMATION FILE

The Edit Estimation File program provides a means of modifying estimation files. The user may specify a record number, an exact entry, or a search 'string' to access a particular record.

PERFORM ESTIMATION

The Perform Estimation program permits the user to run estimates based on the items chosen for the estimate and the usage. Also, while performing an estimate, the user may update the estimate file with relevant changes. In addition, the user has the option of generating the estimate totals, an internal report, or a customer report.

ESTIMATION CHANGE AND/OR REPORT

This is a utility program which is capable of performing two basic functions. First, it allows the user to modify or correct a previously defined estimate. Then, after correcting the estimate, the user may run the corrected estimate without having to re-enter the specifications.

OS-DMS FILE DIRECTORY

The OS-DMS File Directory selectively lists OS-65U files. The user specifies the type of file(s) to display; the program scans through the OS-65U directory and prints out the specified file names.

THE ESTIMATION SYSTEM CAPABILITIES

Because of its ability to perform several special functions, the Quotation/Estimation package can be cost justified by a businessman who performs frequent estimates for projects or products. These functions include the generation of hard copy reports, built-in edit features, reusable estimates, user specified options, and OS-DMS file compatibility. However, a businessman who performs only two or three estimates a year would be better off performing the estimates manually and having his secretary type it.

The following is a brief discussion on each of the functions mentioned above.

1. The OS-DMS Estimation System has the ability to generate two types of hard copy reports: an internal report and a customer report. Generating hard copies of the two reports eliminates having to dictate the estimate form and figures to a secretary and having her manually type the report.

2. There are three methods of editing the estimation files:

- During the initialization of each estimate (while running "Perform Estimate") any given item or the prices representing that item may be modified. What this means is that instead of having to manually edit the estimation file, the user can update each entry while running the estimate.
- After running an estimate, if for some reason the user decides that the estimate needs to be changed, updates can be made by running the "ESTIMATION CHANGE AND/OR REPORT" program. This program lets the user make the necessary changes and run the estimate again.
- The third type of editor is the OS-DMS Editor which allows manual edit functions at any time. The OS-DMS Editor is also the program that is used for the initial entry of data in the files.

3. When running an estimate the user has two options that may be selected:

- The user may add a variance to the totals for each heading. If a variance is desired, the user also has the option of specifying the variance as an amount or as a percentage of the totals per heading.
- Secondly, the user must specify whether or not to display the profit margin on the customer report and, if so, whether to calculate it on the retail or the wholesale price.

4. The OS-DMS Estimation System is compatible with the other OS-DMS modules. This common bond permits the user to link files, e.g., the estimation files to the inventory files. This compatibility enhances the estimation module considerably because it means that the OS-DMS Nucleus utilities can be used with the estimation programs.

THE ESTIMATION SYSTEM REPORTS

This system produces three types of reports shown below:

The Initial Entry Listing. This report indicates all of the inputs which were used to perform a given calculation.

QUOTATION ESTIMATION -- (INITIAL ENTRY LISTING)			
MASONRY MATERIALS			
ITEM	WHOLESALE	RETAIL	UNIT
CEMENT	6.15	8.00	PER 50 LB. BAG
5			
SAND	2.50	5.00	A TON
2			
GRAVEL	8.00	15.00	A TON
1			
ANCHOR BOLTS	.60	1.50	EACH
8			
WIRE REINFORCING	.95	2.00	PER SQ. FT.
58			
VARIANCE (Y OR N) Y			
IS THE VARIANCE GOING TO BE			
1) AN AMOUNT			
2) A PERCENTAGE			
1			
AMOUNT OF VARIANCE			
3			
LUMBER			
ITEM	WHOLESALE	RETAIL	UNIT
1 x 1	.01	.05	PER FT.
1 x 2	.03	.08	PER FT.
1 x 4	.04	.12	PER FT.
100			
1 x 6	.05	.15	PER FT.
8			
2 x 2	.05	.15	PER FT.
2 x 3	.06	.18	PER FT.
2 x 4	.08	.20	PER FT.
342			
2 x 6	.09	.25	PER FT.
66			
2 x 8	.10	.30	PER FT.
2 x 10	.12	.35	PER FT.
2 x 12	.14	.40	PER FT.
4 x 4	.10	.30	PER FT.
4 x 6	.14	.40	PER FT.
VARIANCE (Y OR N) N			

PLYWOOD

ITEM	WHOLESALE	RETAIL UNIT
1/8 INCH	7.40	9.20 A SHEET 4' x 8'
1/4 INCH	8.15	10.00 A SHEET 4' x 8'
3/8 INCH	9.40	11.20 A SHEET 4' x 8'
1/2 INCH	10.55	12.00 A SHEET 4' x 8'
5/8 INCH	11.35	13.20 A SHEET 4' x 8'
3/4 INCH	12.10	14.00 A SHEET 4' x 8'
7/8 INCH	13.85	15.20 A SHEET 4' x 8'

The second report is the Internal Report. The Internal Report is a company-oriented report which contains the amount of usage for each item selected, the item, the wholesale and retail prices, how the unit is sold, the totals per item, and the final totals per heading. At the end of the report are the grand totals and the profit margin. The Internal Report is primarily for managerial personnel so that they can analyze it and decide whether or not the estimate is accurate and perhaps whether they should make a bid on the project.

SACKER CONTRACTING INC.
22413 S. GROVE STREET
YONKLE, NEW JERSEY 51227
785-6641

INTERNAL REPORT

PAGE 1

DATE: 4/22/79
NAME: BOB LINDEN
PROJECT: TOOL SHED
DESCRIPTION: 6 FT. WIDE, 8 FT. LONG & 7 FT. HIGH (BUILD OUT OF WOOD)
MISC.
ESTIMATED TIME OF COMPLETION: 2-3 DAYS

MASONRY MATERIALS		WHOLESALE	RETAIL UNIT	WHSL TOTAL	RETAIL TOTAL
USAGE	ITEM				
5	CEMENT	6.15	8.00 PER 50 LB. BAG	30.75	40.00
2	SAND	2.50	5.00 A TON	5.00	10.00
1	GRAVEL	8.00	15.00 A TON	8.00	15.00
8	ANCHOR BOLTS	.60	1.50 EACH	4.80	12.00
58	WIRE REINFORCING	.95	2.00 PER SQ. FT.	55.10	116.00
	VARIANCE	3.00	3.00	3.00	3.00
			TOTAL	106.65	196.00

LUMBER		WHOLESALE	RETAIL UNIT	WHSL TOTAL	RETAIL TOTAL
USAGE	ITEM				
100	1' x 4	.04	.12 PER FT.	4.00	12.00
8	1' x 6	.05	.15 PER FT.	.40	1.20
342	2' x 4	.08	.20 PER FT.	27.36	68.40
66	2' x 6	.09	.25 PER FT.	5.94	16.50
			TOTAL	37.70	98.10

PLYWOOD		WHOLESALE	RETAIL UNIT	WHSL TOTAL	RETAIL TOTAL
USAGE	ITEM				
8	3/8 INCH	9.40	11.20 A SHEET 4' x 8'	75.20	89.60
3	5/8 INCH	11.35	13.20 A SHEET 4' x 8'	34.05	39.60
			TOTAL	109.25	129.20

LABOR		WHOLESALE	RETAIL UNIT	WHSL TOTAL	RETAIL TOTAL
USAGE	ITEM				
12	CARPENTER	10.40	20.00 AN HOUR	124.80	240.00
4	MANUAL LABORER	8.60	15.00 AN HOUR	34.40	60.00
			TOTAL	159.20	300.00

MISC. MATERIALS		WHOLESALE	RETAIL UNIT	WHSL TOTAL	RETAIL TOTAL
USAGE	ITEM				
1	TAR PAPER	6.65	8.40 A ROLL	6.65	8.40
3	SHINGLES	18.10	21.20 A BUNDLE	54.30	63.60
2	NAILS	3.25	4.50 A LB.	6.50	9.00
			TOTAL	67.45	81.00

Finally, the Customer Report is similar to the Internal Report, except that it does not display any of the wholesale numbers and the user must specify whether or not to display the profit margin on the report. If the profit margin is on the report, the user must also specify whether the profit margin should be calculated on the wholesale or retail cost and, unlike the Internal Report, the profit margin is displayed as a percentage.

SACKER CONTRACTING INC.
22413 S. GROVE STREET
YONKLE, NEW JERSEY 51227
785-6641

CUSTOMER REPORT

PAGE 1

DATE: 4/22/79
NAME: BOB LINDEN
PROJECT: TOOL SHED
DESCRIPTION: 6 FT. WIDE, 8 FT. LONG & 7 FT. HIGH (BUILD OUT OF WOOD)
MISC.
ESTIMATED TIME OF COMPLETION: 2-3 DAYS

MASONRY MATERIALS		COST UNIT	TOTAL
USAGE	ITEM		
5	CEMENT	8.00 PER 50 LB. BAG	40.00
2	SAND	5.00 A TON	10.00
1	GRAVEL	15.00 A TON	15.00
8	ANCHOR BOLTS	1.50 EACH	12.00
58	WIRE REINFORCING	2.00 PER SQ. FT.	116.00
	VARIANCE	3.00	3.00
		FINAL TOTAL	196.00

LUMBER		COST UNIT	TOTAL
USAGE	ITEM		
100	1' x 4	.12 PER FT.	12.00
8	1' x 6	.15 PER FT.	1.20
342	2' x 4	.20 PER FT.	68.40
66	2' x 6	.25 PER FT.	16.50
		FINAL TOTAL	98.10

PLYWOOD		COST UNIT	TOTAL
USAGE	ITEM		
8	3/8 INCH	11.20 A SHEET 4' x 8'	89.60
3	5/8 INCH	13.20 A SHEET 4' x 8'	39.60
		FINAL TOTAL	129.20

LABOR		COST UNIT	TOTAL
USAGE	ITEM		
12	CARPENTER	20.00 AN HOUR	240.00
4	MANUAL LABORER	15.00 AN HOUR	60.00
		FINAL TOTAL	300.00

MISC. MATERIALS		COST UNIT	TOTAL
USAGE	ITEM		
1	TAR PAPER	8.40 A ROLL	8.40
3	SHINGLES	21.20 A BUNDLE	63.60
2	NAILS	4.50 A LB.	9.00
		FINAL TOTAL	81.00

--ESTIMATED PRICE IS \$804.30--
--PROFIT MARGIN IS 40.28%--

OS-DMS TESTING/TUTORING SYSTEM

Today, the educational challenge is great! That is why instructors are constantly searching for learning aids and better methods of teaching. Instructors have found that if some types of audio-visual aids are used, students tend to learn more quickly and easily. Examples of such aids are slides, films, field trips and, the newest and latest audio-visual aid, the computer.

With our ever-growing technology, scientists are constantly discovering new tasks the computer can perform. The computer promises to turn the day to day operations into a lifetime learning process.

To aid the teacher in the classroom, Ohio Scientific has developed the OS-DMS Educational System. It is designed to allow a teacher who is not trained in the use of a computer to quickly and efficiently set up a quiz or tutorial session, have the students do the required work on the computer, and then give the student a grade and record the grade automatically. Additionally, it allows the teacher to define practically any type of test or lesson desired, depending on the program specifications defined.

--RETAIL PRICE IS \$804.30--
--WHOLESALE PRICE IS \$480.25--
--PROFIT MARGIN IS \$324.05--

The OS-DMS Educational System is obviously not a business package, but it could possibly be tied in with our business applications. For example, a school could purchase the Educational System to be used by all the instructors as an aid in tutoring and giving quizzes. If the Educational System seemed to be a success with the students and the instructors, the school could then purchase the Account Payable/Receivable, Personnel, General Ledger, and possibly the Inventory system. By setting up model accounts and companies on these systems, the students in the business courses such as general business, bookkeeping, accounting, etc., can get first-hand experience in real life situations. Because the OS-DMS modules are systems that are written for real life applications, the school could additionally use these systems for their own purposes.

The following is a copy of the Instructor's Menu:

OS-DMS EDUCATIONAL SYSTEM

Functions

- (1) CREATE A GRADE FILE
- (2) CREATE A QUIZ OR TUTOR FILE
- (3) REVISE A QUIZ OR TUTOR FILE
- (4) REVIEW A GRADE FILE
- (5) SCORE CONFIRMATION
- (6) DMS FILE DIRECTORY
- (98) RETURN TO THE STUDENT MENU
- (99) EXIT

OS-DMS EDUCATIONAL OVERVIEW

The following is a short key to the programs on the Instructor's Menu.

CREATE A GRADE FILE

This allows the instructor to create Grade Files. The Grade File contains the name of each student, student number, the total number of possible points for each quiz, the number correct and the number incorrect. The instructor specifies the device the file is to be stored on, the file name, the password, and the number of students to be included in the file.

CREATE A QUIZ OR TUTOR FILE

Before a quiz or tutor can be written, the instructor must create Quiz or Tutor files. The Quiz and Tutor files are similar except that the first letter of a quiz must begin with a "Q" and the first letter of a tutor must begin with a "T". Both contain the questions, the answer to each question, two miscellaneous fields and the points that each question is worth. The instructor specifies the device the file is to be stored on, the file name, the password, whether this is a Quiz or Tutor file, the number of questions, and the maximum number of lines to reserve for each question.

REVISE A QUIZ OR TUTOR FILE

This program provides a means of editing Quiz and Tutor files. It also has other built-in features such as the ability to generate a hard copy of a quiz or tutor, allowing the instructor to erase an entire Quiz or Tutor file and permitting him or her to set certain specifications for a Quiz or Tutor file.

REVIEW GRADE FILE

This program provides editing features, permits easy retrieval of student scores, has the ability to append and delete students, and can generate a printed listing of all the students and their scores.

SCORE CONFIRMATION

After the deadline for taking a quiz has passed, the instructor is required to run this program. This program looks in the Grade File to see what students have not taken the quiz. Whenever a student does not have a score recorded for the latest quiz, the program gives that student a zero for the quiz score, and displays a list of the students who did not take the quiz.

THE EDUCATIONAL SYSTEM CAPABILITIES

The OS-DMS Educational System was designed to assist instructors in two primary areas of teaching: tutoring and testing. Both have several special built-in features which make the Educational System quite unique. Since all instructors do not give tutors and quizzes in the same fashion, these features are essential because they allow the teachers to individualize their lessons and quizzes.

The following is a brief discussion on each of the features for a tutor and a quiz.

TUTOR

Tutors can be used for a wide variety of applications. Some instructors might use the tutoring program to assist those students that are having difficulty in their classes, others might use it to test one's knowledge and others as a review for finals.

The operational decisions to be made by the instructor when setting up a tutorial session are as follows:

1. Specify whether or not Structured Learning should be used.

Structured Learning is a tutoring program specifically designed to use multiple choice and/or matching questions. Structured Learning reviews any particular topic; i.e., the capital of each state or the presidents of the United States. The program begins by displaying the first question with four possible choices. If an incorrect answer is chosen, the program will tell the student why the answer he chose was wrong and will ask the same question again. This process will continue until the question is answered correctly.

Note:

A Tutor file established for Structured Learning must pertain to one particular topic throughout the file; the program randomly selects three answers from any question in the file. If the file does not pertain to a particular topic, the three answers selected may not relate with the question.

2. Select the Input/Output (I/O) device.

If a line printer is available, the instructor has the option of generating a hard copy of the questions, the student's answers and the student's score. The purpose for generating a hard copy of the tutor is to supply the student with a study sheet as a review for finals or to give the instructor written results of how much his students have remembered from a past quiz or lesson.

3. Specify whether or not the student should have a second chance to answer each question correctly.

4. Specify whether or not the student should be told the correct answer after the question has been answered incorrectly.

5. Specify whether the student should be shown the score.

6. If a Level III machine is available, the instructor may specify a time limit for the tutor.

QUIZ

Like tutors, quizzes also can be written and used in a variety of ways. Because of this, the quiz program also has several built-in features. Unlike the tutor, however, when a quiz is being run, the program automatically checks if the student taking the quiz has taken it before. It also checks to see if the student number exists. If the student has taken the same quiz before or the student number does not exist, the program will inform the student that he cannot take the quiz and will exit the system. Also, after a quiz has been taken, the program automatically writes the student's score in the student grade file.

The operational decisions to be made by the instructor when setting up a test are as follows:

1. Select the Input/Output (I/O) device.

Since the student's answers to individual questions are not recorded anywhere, the instructor might want to generate a hard copy of each student's quiz. Later, after the quiz, the instructor could distribute the quiz papers and go over the questions with the students.

2. Specify whether to display the questions randomly or sequentially.

This feature helps eliminate possible cheating by students. If the questions are scrambled for each student, the passing of answers would be useless unless the student wrote down each question and the answer to it.

3. Specify whether the student should be shown his score.

4. If a Level III machine is available, the instructor may specify a time limit for the quiz.

THE OS-DMS INVENTORY CONTROL SYSTEM

The OS-DMS Inventory Control System is an automated computer system designed to provide the end user with specific information concerning the current status of the inventory. This system is menu oriented so only minimal computer knowledge is needed.

There are three sub-systems which make up the Inventory Control System: the Inventory System, the Purchasing System, and the Bills of Material System. These sub-systems were designed to run independently or in an integrated mode. If a particular end user is using all three systems, data may be passed from one to the other. This allows the end user to slowly integrate computerized operations into the business without sacrificing the benefits of integrated business software.

INVENTORY SYSTEM

The Inventory System enables the inventory control clerk to accurately keep track of the current inventory levels and value. This is accomplished by providing the functions shown on the following menu:

OS-DMS INVENTORY MENU

- (1) CURRENT QUANTITY IN STOCK REPORT
- (2) INVENTORY USAGE STATUS REPORT
- (3) REORDER REPORT
- (4) CURRENT INVENTORY VALUE REPORT
- (5) ARCHIVE INVENTORY REPORT
- (6) GENERAL CONDITIONAL INVENTORY REPORT
- (7) ORDER ENTRY
- (8) STOCK CHECK
- (9) REMOVE OR SHIP ITEMS FROM INVENTORY
- (10) RECEIVE ITEMS INTO INVENTORY
- (11) UPDATE CURRENT QUANTITY IN STOCK VALUES
- (12) GENERAL INVENTORY EDIT
- (13) SET A REORDER LEVEL
- (14) SET AN AVERAGE USAGE
- (15) ALPHABETIZE INVENTORY RECORDS
- (16) COPY OR BACKUP DISKETTES
- (99) EXIT

These functions can be divided into three areas: the report writers, the day to day operations, and the maintenance functions.

The report writers are used to inform management of the status of the inventory. The Inventory Usage Status Report provides detailed information such as average weekly usage, weeks on hand and weeks on order for each inventory item. The Inventory Value Report calculates the current value of the inventory using the average unit costs. A general report writer is included to handle the occasional reports that are requested.

The day to day operations such as stock checks, entry of received goods and inventory adjustments have been optimized for maximum speed and accuracy. A record is made of all input transactions to aid in the correction of input errors. The order entry program will mark items ordered and generate an invoice.

The maintenance functions allow the end user to make copies of the inventory data in case an error occurs, and to keep the inventory master file in alphabetical sequence. Again, the programs prompt the user with simple, easy to understand instructions.

Throughout the OS-DMS business systems, the amount of computer knowledge the operator needs has been kept to a minimum. This means that any person capable of performing the same business task manually will be able to use this software with minimal instruction.

There are several features that help make this Inventory System useful to the small businessman.

The system maintains an average weekly usage for all items in the inventory. When a stock check is performed, the computer provides a detailed description of the item's current status. The average weekly usage is used along with the quantity in stock and quantity on order values to obtain weeks on hand and weeks on order figures. The current average unit cost is used to determine the value of the inventory. With this data, the inventory clerk has a more informative picture of the state of inventory than a simple quantity in stock report or a reorder report.

PURCHASING SYSTEM

The Purchasing System keeps track of the open purchase orders for inventory items. The purchasing clerk can quickly determine if a particular part is on order and, if so, with which vendors. The Overdue Order Age Analysis will list the purchase orders that are overdue. The Outstanding Order Age Analysis will list all currently outstanding purchase orders.

If a particular end user has the Inventory System and the Purchasing System, they may be integrated. Each system will remain independent in that minor changes to the operation of the Purchasing System will not interfere with the Inventory System. The Purchasing System is capable of posting the quantity on order for each item into the Inventory System. With these figures, the Inventory System can generate an inventory value report with the dollar value on order for each part. When a part is received by the receiving clerk and entered into the Inventory System, the Inventory System increments the quantity in stock field and decrements the quantity on order figures.

INVENTORY SYSTEM

OS-DMS PURCHASES MENU

- (1) PURCHASES MASTER UPDATE
- (2) PRINT/DISPLAY PURCHASES JOURNAL
- (3) COMPLETE PURCHASES MASTER DUMP
- (4) CONDITIONAL PURCHASES MASTER DUMP
- (5) PURCHASES MASTER EDIT
- (6) PRINT AGE ANALYSIS—OVERDUE ORDERS
- (7) PRINT AGE ANALYSIS—ALL OUTSTANDING ORDERS
- (8) CREATE NEW PURCHASES MASTER FILE
- (9) PRINT PART NUMBER LIST
- (10) BACKUP PURCHASES MASTER FILE
- (11) EXIT PURCHASES SYSTEM

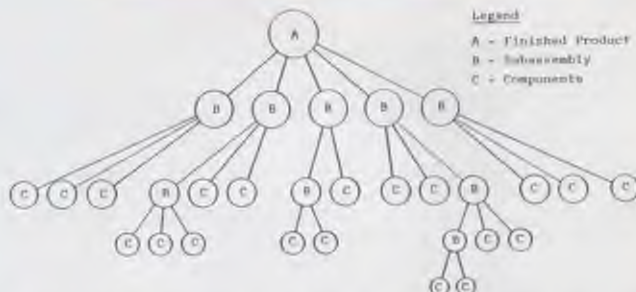
BILL OF MATERIAL AND EXPLOSION FUNCTIONS

- (1) INTRODUCTION
- (2) EXPLOSION INPUT FUNCTIONS
- (3) EXPLODE ITEMS ALREADY ENTERED
- (4) EXPLOSION OUTPUT FUNCTIONS
- (5) LIST ALL SUBASSEMBLIES THAT CAN BE EXPLODED
- (6) LIST A BILL OF MATERIAL FOR A SUBASSEMBLY
- (7) CREATE A BILL OF MATERIAL FILE
- (8) EDIT A BILL OF MATERIAL FILE
- (9) DELETE A BILL OF MATERIAL FILE
- (10) CREATE A COPY OR BACK UP A DISKETTE

BILLS OF MATERIAL SYSTEM

The Bills of Material System allows for the creation, modification and deletion of bills of material for inventory subassemblies as well as the automatic breakdown of subassemblies into their component parts. The functions are selected through a menu system.

Before a part breakdown or explosion can be run, the end user must enter a bill of material for every item that can be broken down. Once these bills have been entered, the end user can have the computer break down finished goods and subassemblies into their component parts. The maximum number of levels of breakdown or explosion for a particular item depends on the number of levels in the bills of material for that item. For example, a particular business manufacturer's television set has twenty subassemblies itemized on its bill of material. If each of the twenty sub-assemblies has a bill of material, the system can do a two-level breakdown. It is common to have another bill of material for most or all of the items on each of the sub-assemblies' bills of material. This would permit the system to perform a three-level breakdown or explosion. This can be expanded to whatever depth the end user desires. The following is a multi-level breakdown.



Legend

- A - Finished Product
- B - Subassembly
- C - Component

When a part breakdown is finished, the end user can direct the computer to either increment or decrement an inventory file with the results of the breakdown or print the results in alphabetical order on the terminal or printer. This system provides a means of tracking inventory items that cannot be easily counted manually. The weekly shipping list can be broken down or exploded into raw inventory components. These figures could be used to adjust the quantity in stock figures for those items.

The Bills of Material System can be integrated into the Inventory Control System. When a bill of material is being printed, the end user has the option of having the computer look at the inventory file for the description and the latest average unit cost for each component on the bill. This means that the bill of material will have the latest and most accurate description and price. This eliminates the need for the double entry of data when the cost or description changes.

EXPLOSION FILE DUMP

PAGE 1

PART NUMBER: CA-6CP

DESCRIPTION: GENERAL PURPOSE 10-MEMORY BOARD

PART NUMBER	QUANTITY	DESCRIPTION	TOTAL COST
PC-61	1	ACCESSORY BOARD	16.42
SC-12MM	2	12 PIN MA MOLEX PLUG 09-64-1121	.27
SC-16FI	10	16 PIN INTEGRATED CIRCUIT SOCKET	1.20
SC-18FI	40	18 PIN INTEGRATED CIRCUIT SOCKET	6.96
SC-24FI	1	24 PIN INTEGRATED CIRCUIT SOCKET	.10
SC-40FI	3	40 PIN INTEGRATED CIRCUIT SOCKET	.39
C-151	2	150 PF.	.10
C-102	2	.001 MF.	.14
C-306	2	50 MF.	.16
CB-10410	39	1 MF. BYPASS 10 VOLT	1.70
R1-102	4	1K OHMS 1/4 WATT 5%	.04
R1-221	12	220 OHMS 1/4 WATT 5%	.12
R1-391	12	390 OHMS 1/4 WATT 5%	.12
R1-471	8	470 OHMS 1/4 WATT 5%	.08
R1-472	2	4.7K OHMS 1/4 WATT 5%	.02
RP-103	4	10K OHMS THERMISTOR POT.	1.64
IC-74LS00	1	TTL	.21
IC-74LS04	2	TTL	.33
IC-74LS02	1	TTL	.14
IC-74LS10	1	TTL	.14
IC-7417	4	TTL	.76
IC-74LS20	1	TTL	.23
IC-74LS93	1	TTL	.26
IC-74123	2	TTL	.64
IC-74LS138	4	TTL	1.40
IC-74LS390	3	TTL	2.13
IC-8128	2	BUFFER	1.62
IC-8195	3	BUFFER	1.89
IC-68850	1	PIA	4.00
IC-68821	1	PIA	4.00
IC-12114-550	32	RAM	116.80
HW-SP-75	4	PLAS. SPAC. 3/4 L. SMITH 4167	.12
HW-MAN	8	NYLON WASHER 1/8 SMITH 2673	.09
HW-S6321.25	4	SCREW 1-1/4 X 6-32	.04
W-406J	1	40 COND 6" L. FL. CA. JUMP AP PROO	4.52
W-15118	1/L	1 CONDUCTOR STRANDED 18 GA.	.03
SC-3PC	1	3 PIN FE MOLEX CON 03-09-1032	.05
SC-17FH	2	FEH TERM. MOD. 02-09-1118	.02
SC-1FTH	2	MALE TERM. MOD. 02-09-2118	.02

SUMMATION OF TOTAL COSTS USING CURRENT INVENTORY AVERAGE UNIT COSTS = 149.50

SUMMARY

The OS-DMS Inventory Control System is comprised of three independent sub-systems: the Inventory System, the Purchasing System, and the Bills of Material System. These systems may be run in an independent or integrated mode depending on the degree of sophistication the end user desires. The overall system is flexible enough that it can be implemented in stages to allow the end user time to adjust to computerized business methods. These three systems, when combined with the other OS-DMS business packages, represent a major step in the development of efficient, easy to use microprocessor-based business software.

This is my first issue as author of the PET-pourri column; I hope to continue providing interesting and useful information on the PET. With only a week to assemble this first installment, I didn't have enough time to gather much information on new products. By the next issue, I hope to find more products to review, or at least be able to provide more information.

I've been requested to review more programs and hardware accessories for the PET whenever I can acquire them for evaluation. Since most PET owners still buy via mail order, I'll try to provide as much information as possible on each product I learn of or try on my own system. This should make it easier to choose the items of greatest interest for your particular system. It has been suggested, however, that I avoid reviewing game programs unless they are extraordinary.

I'll also try to include programming tips and ideas that I feel may be of value. If you'd like to share any of your own programming tricks or newfound secrets of the PET operating systems, I'd be happy to hear from you. I have one request: Please enclose an SASE if you expect a reply. All mail should be addressed directly to me and not through the magazine to avoid forwarding delays.

New Products and Publications

A new printer manufactured by Shinshu Seiki is available for the PET, and it appears similar to the Commodore printer. The Model TX-80 dot-matrix impact printer operates at 150 characters per second. It is available with friction feed or tractor feed and uses standard paper, four to ten inches in width. With 80 characters per line, double-size characters and PET graphics, it appeared to be a nice unit when displayed at PCC '79 in Philadelphia last fall. The printer has been advertised under several names and at varying prices, but lists for about \$900 with tractor feed and all interface cables for the PET.

If you have an 8K PET and still haven't replaced your small key-

board, I suggest you check the article in the October 1979 issue (page 82) on the keyboard from Century Research & Marketing. Having used one for several months, I've discovered I like the keyboard with the molded-in graphics and expanded numeric pad.

The PET Gazette has become a full-size, bimonthly magazine called *Compute, the Journal for Progressive Computing*. The magazine is divided into four sections:

- 6502 section with articles of interest to everyone with a 6502-based machine.

- Business and industrial applications.

- Educational guide to teachers.

- Gazettes for each "special" machine, including the PET, Apple, Atari and single-board computers (SBCs).

Mail-order subscriptions are \$9 per year, and the magazine is published by Small Systems Services, Inc., 900 Spring Garden St., Greensboro NC 27403. The sample issue distributed at PCC '79 was impressive; hope they keep up the good work.

Both Instant Software, Peterborough NH, and New England Electronics (NEECO), 679 Highland Avenue, Needham MA 02194, have been distributing new catalogs. If you haven't received one yet, I suggest you write for one soon. NEECO's General Ledger program is available; I hope to have details on it in time for the next issue.

What About the Axiom Printers?

Although the Axiom electrostatic printers for the PET have been available for over a year, there has been very little mention of these printers in most PET publications or columns. Two models of interest to PET owners offer uppercase and lowercase alphanumeric as well as all PET graphics. The EX-801 PET model is a general-purpose printer, while the EX-820 PET model provides true reproduction of the PET graphics by eliminating extra spacing between printed lines, as occurs on the EX-801. The small, quiet printers have a print

speed of 120 lines per minute. They were designed to require a minimum of maintenance, and the printhead should last for one to two million lines of printing. This is roughly equivalent to about 140 rolls of paper; a replacement printhead is available for \$45.

The printers provide functions that are selected using various control characters as follows:

LIST MODE, CHR\$(9) —

All cursor controls are printed as shown on a normal screen listing. This is the mode selected automatically at power-on or on-line and is used for printing BASIC program listings.

PRINT MODE, CHR\$(8) —

All output is printed as it would be displayed on the screen during program execution. Cursor right and SPC commands produce printed spaces, while other cursor controls are ignored. TABs and number formatting using the comma may not produce correct results.

40 COLUMN, CHR\$(12) —

Selects 40-column printout, which is normally selected auto-

matically at power-on.

80 COLUMN, CHR\$(11) —

Selects 80-column printout until 40-column printout is reselected. Character sizes may be intermixed in any combination on a line however desired by switching back and forth between the two sizes.

GRAPHICS, CHR\$(15) —

Prints PET graphics and uppercase letters providing printout compatible with the POKE 59468,12 mode on the PET.

LOWERCASE, CHR\$(14) —

Prints lowercase alphabetic in place of graphics the same as a POKE 59468,14 on the PET. Character types may be intermixed on a line by switching modes back and forth if graphics are desired along with uppercase and lowercase letters.

BELL, CHR\$(7) —

Sounds the internal buzzer for 1/4 second when the line is printed containing this control mode.

Two other control characters are listed in the manual to turn the loudspeaker on and off for direct program control of sound ef-

```
10 REM TAPE HEX DUMP PROGRAM
20 REM BY: ROBERT W. BAKER
30 REM
40 REM DISPLAYS A HEX DUMP OF
50 REM TAPE DATA FILES.
60 :
70 H$="0123456789ABCDEF"
80 PRINT "TAPE HEX DUMP"
90 PRINT:PRINT:PRINT "HIT ANY KEY TO"
100 PRINT "HOLD/CONTINUE THE DISPLAY."
110 PRINT:PRINT "HIT 'D' WHEN DONE TO"
120 PRINT "STOP BEFORE END OF FILE."
130 PRINT:PRINT
140 OPEN 1
150 S$=""
160 PRINT "TAPE HEX DUMP":PRINT:PRINT
170 B=0:GOTO 250
180 GET#1,C$
190 IF ST<>0 THEN 320
200 A=ASC(C$):A1=INT(A/16)
210 PRINT MID$(H$,A1+1,1);
220 PRINT MID$(H$,A-(A1+1)+1,1);";
230 B=B+1
240 IF INT(B/10)<>B/10 THEN 270
250 PRINT
260 PRINT RIGHT$(S$+STR$(B),5);";
270 GET C$:IF C$="" THEN 180
280 IF C$="D" THEN 320
290 GET C$:IF C$="" THEN 290
300 IF C$="D" THEN PRINT:END
310 GOTO 180
320 PRINT:PRINT:PRINT "ST =" ;ST
```

Listing 1. Tape hex dump program.

fects.

I've not been able to make this work, and no information is provided on how to use the controls. The printers do provide automatic printing on the reception of the 81st, 41st or equivalent character, depending on the line characteristics.

The IEEE interface board mounts on the back of the PET at the IEEE bus connector with a ribbon cable connected to the printer. The interface board provides a true IEEE bus connector in addition to reproducing the IEEE edge connector of the PET for other Commodore products. The printer is connected via the IEEE interface but will recognize any device address on the IEEE bus. This was probably done to eliminate the costly circuitry to recognize a specific device address on the IEEE bus and keep the printer cost at a minimum. However, a switch on the front panel of the printer does allow the user to put the printer on or off line to avoid this problem of recognizing all bus addresses.

Two other switches on the printer provide manual paper feed and a built-in self-test mode. When the printer runs out of paper, the bell will sound continuously and all printing will stop.

Having used an EX-801 for over six months now on my own system, I've been impressed by the print quality and the printer reliability. Having the capability of producing true listings of BASIC programs with all cursor controls shown has saved many hours of work on several occasions. My only dislike is the 5 1/2 inch wide electrostatic paper that costs about \$6 per roll and can be hard to find on occasion... probably the major drawback of this type of printer. However, a 300-foot roll of paper usually lasts for well over a month on my system, even with very heavy use.

If the impact printers are too expensive for your current budget, but you definitely need a printer, you should consider the \$495 EX-801 Axiom printer, with the ability to get true program

listings compared to other low-cost printers that do not print all PET graphics. If you do decide to get an Axiom printer, make sure you get a model designed for the PET with the IEEE interface. Axiom markets a complete line of printers, and the PET models have a special internal ROM in addition to the IEEE interface to provide all the particular features for the PET.

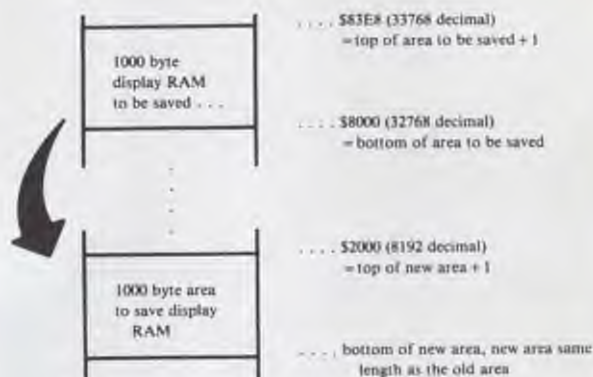
Programming Ideas and Tips

If you are experimenting with tape data files, this simple program (Listing 1) can help display the exact contents of any data file. It reads the file byte-by-byte and displays the hexadecimal value of each byte in the file, including all separator and control characters. The display will list ten bytes per line with a byte count indicated in the left column, which makes it extremely easy to determine the exact format of any data file.

Machine-language programmers might be interested in the following two routines that are contained in the older 8K PET operating system. I plan to check where these routines are located in the new operating system in the near future. I should be getting my new ROM set any day.

Block Move: This routine will move the contents of a contiguous block of memory locations from one area of memory to a new area of memory. The routine starts at hex location \$C2E1 (49889 decimal) and uses the following pointers in low memory, which must be set prior to calling this subroutine.

\$A9 = hex \$E8 (232 decimal) top address = hex \$83E8 (33768 decimal)
\$AA = hex \$83 (131 decimal) bottom address = hex \$8000 (32768 decimal)
\$AE = hex \$00 bottom address = hex \$8000 (32768 decimal)
\$AF = hex \$80 (128 decimal) new top address = hex \$2000 (8192 decimal)
\$A7 = hex \$00 new top address = hex \$2000 (8192 decimal)
\$A8 = hex \$20 (32 decimal) new top address = hex \$2000 (8192 decimal)



Example 1.

Hex locations \$A9 and \$AA (169 and 170 decimal) contain the address, plus one, of the last byte to be moved, the upper limit of the old area. Hex locations \$AE and \$AF (174 and 175 decimal) contain the address of the first byte to be moved, the lower limit of the old area. Hex locations \$A7 and \$A8 (167 and 168 decimal) contain the address, plus one, of the last byte to be moved to, the upper limit of the new area. All address pointers are in the standard format of the low byte of the address first then the high byte of the address.

As an example, suppose you wanted to move the 1000 bytes of the display RAM into the top of your 8K program RAM to save the data for some reason. Before

calling the block move subroutine you would set the pointers as shown in Example 1.

Search for a BASIC Line Number: This routine will search through all the lines of a BASIC program in memory looking for a specific line number. The line number to be found must be placed in locations 8 and 9 prior to calling this subroutine at hex location \$C522 (50466 decimal). The line number is stored in standard address format, low byte first. On return from the subroutine, the processor carry bit will indicate whether the line number was found or not. The carry bit will be clear (0) if the line was not found. If the line was found the carry bit will be set (1) and hex locations \$AE and \$AF (174 and 175 decimal) will

Connector pin	Wire color	Joystick function (switch)
1	***no connection***	
2	Brown	Right
3	Green	Left
4	Blue	Bottom
5	White	Top
6	***no connection***	
7	Black	(switch common)
8	***no connection***	
9	Orange	Button

Joystick Control #1

Orange (9) (button)

Brown (2) C (right)
Green (3) D (left)
Blue (4) E (bottom)
White (5) F (top)

Black (7) 1, 11, 12, A or N System ground

Joystick Control #2

Black (7)
Brown (2) H (right)
Green (3) J (left)
Blue (4) K (bottom)
White (5) L (top)

Orange (9) (button)

Joystick connector wiring and interface to PET user port.

contain the address of where the line is located in memory.

This routine can then be used to create self-modifying programs, store data within a program DATA line or delete program instructions. I hope to cover some of these fancy program tricks in future columns. They're quite easy once you've tried them.

Simple Joystick Interface for the PET

Cursor magazine is providing some of the best software for the PET, with some very fancy games currently available. Now that they are providing more programs that use joysticks, you may want to add a pair to your system to take full advantage of these new programs. *Cursor's* programs are designed to work with all three of the dual Atari joystick adapters currently available from Coyote Electronics, Box 101, Coyote CA 95013; Creative Software, Box 4030, Mountain View CA 94040; Chuck Johnson, 17104 Via Alamos, San Lorenzo CA 94580.

If you'd rather construct your own interface, the joysticks can be ordered directly from Atari. Sears Roebuck and Co. lists them on page 651 of their Christmas Catalog at \$9.95 each (catalog #6C99835). The accompanying diagram shows a simple interface to connect two joysticks to the PET user port. The joysticks come with a 9-pin subminiature-D connector at the end of the connecting cable. Mating connectors are rather expensive and may be hard to find. You may want to cut these connectors off and wire the joysticks directly to your user port connector. The diagram shows both the connector pin number and the internal wire color for whichever scheme you choose to use.

The interface simply connects each switch to a separate input line of the user port. The joystick button is then connected to the TOP and BOTTOM switches, using two diodes to isolate the three switches. This combination provides a unique 4-bit code at the user port for each joystick position. I haven't been able to compare this interface with those commercially available, but it does work well with the *Cursor* programs.

Please address any correspondence to: Robert W. Baker, 15 Windsor Drive, Atco NJ 08004.

COMPUTER CLINIC

The Craig County Virginia Public Schools have recently placed Level II TRS-80s in pilot programs in both elementary and secondary schools. These machines are being used with computer-assisted instruction (CAI) and educational programs. Because of an apparent scarcity of CAI programs, K-12, school personnel and advanced secondary students are developing such programs. This process is slow, however, when the ultimate objective is to offer CAI in a variety of subjects at all grade levels. We would be glad to contact schools and/or individuals interested in exchanging programs they have developed.

Earl R. Savage
Craig County Public Schools
PO Box 245
New Castle VA 24127

I have a terminal of unknown origin (CRT, power supply, boards and keyboard). The only identification I can find is a label: BA Sanders Associates, Inc., Data Systems Division, Model 722-1 F1, Serial #ED0170, NFPA Type II. Does anyone out there

know where I can get schematics, documentation, etc? I will reimburse postage for all replies.

Kendall Stambaugh
5009 Guide Meridian
Bellingham WA 98225

I am trying to find a battery backup for the S-100 bus. I need one already built; however, a set of plans will work as well.

Byron E. Parrish
Clipper Trading Co.
1718 Santa Fe Trail
Grand Prairie TX 75051

A friend and I are each buying PETs with factory auxiliary cassette tape storage. Over the years, we have written BASIC programs to run with our machines. The problem is that we cannot figure out how to efficiently convert our OS Partitioned Data Sets into cassette tapes to load into our PETs. Typing these programs manually from listings would be too error prone and would take forever. A friend suggested we dump the program libraries on seven- or nine-track IBM tapes. We could then shop in software

houses that supplied cassettes for someone to convert our tapes to cassettes. Can anyone suggest where we can get a list of companies or people to try, if the idea is feasible, or, if it is not, suggest a technique that will work.

Mitch Nadler
4283 Bedford Ave.
Brooklyn NY 11229

I have an E & L Instruments MMD-1 microcomputer with an MMD1/1 memory board. As an exercise in digital design, I am planning to add eight 2114s and four 2708s, which I will interface with the abovementioned units. My problem is, I don't know how to go about designing the necessary decoding circuits to drive the memory ICs. Two areas on the boards are labeled "decoding." How do the people who designed the circuits come up with the particular memory decoding that is used. Is there an E & L or other publication dealing with this particular subject. If so, what do I look for?

Gerald F. Gronson
28185 Alden
Madison Heights MI 48071

CLUB NOTES

Washington DC

The Washington Amateur Computer Society is an organization dedicated to personal computing. WACS meets at 7:30 PM on the last Friday of each month in the first-floor lecture hall of Keane Hall, Catholic University of America. Contact WACS c/o 4201 Massachusetts Ave. #168, Washington DC 20016.

Danvers MA

HUG Northshore, a computer club for Heathkit computer users, meets the second Wednesday of each month (7 PM) at Hill Tech Building, 88 Holten St. (third floor), Danvers MA. The

club publishes a monthly newsletter; for a free copy, write to HUG Northshore, PO Box 112, Danvers MA 01923.

Toronto Ontario

The Canadian Compucolor User's Group invites you to join the group and utilize its growing program library. For more information, contact House of Computers, Inc., 368 Eglinton Ave. West, Toronto Ontario, Canada M5N 1A2. 482-4336.

Washington DC

Washington Area KIM Enthusiasts (WAKE) meet the third

Wednesday of each month, 7:30 PM, at the McGraw-Hill Continuing Education Center in DC. For a copy of the current WAKE newsletter, send an SASE to WAKE, c/o Ted Beach, 5112 Williamsburg Blvd., Arlington VA 22207. 538-2303.

Portland OR

Any Sorcerer user living in the southwest Washington and greater Portland area is welcomed to join the Portland Area Sorcerers Users Group, which plans to publish a regular newsletter and hold meetings. For further information, contact either Timothy Huang at 9529 N.E. Gertz Circle, Portland OR 97211, 289-9135 (Mondays and nights); or Gary Emmerson at 631 S.E. 41st, Apt.

43, Portland OR, 233-9684 (nights).

Akron OH

The Akron Digital Group provides tips on hardware and software applications, and plans to offer classes. The group meets the fourth Wednesday of each month, 7 PM, at the Kenmore Public Library, 2200 14th St.

SW, Akron OH. For information, contact Lon Laurich, 107 7th St. NW, Barberton OH 44203. 745-7819.

Hamilton Ontario

Inquiries concerning membership in the Ontario Society for Microcomputers in Education (OSMIE) should be addressed to N. Solntseff, Unit for Computer Science, McMaster University,

Hamilton Ontario, Canada L8S 4K1. OSMIE's goal is to promote the use of microcomputers in all aspects of education.

Phoenix AZ

For \$4 dues per year, you can join the Arizona Computer Society, PO Box 15623, Phoenix AZ 85060. The society meets on the first Tuesday of each month

at 8 PM, Rm. 209, DeVry Institute, 4702 N. 24th St., Phoenix.

Fairfield CA

The Solano TRS-80 User's Club (STUC) meets informally every third Thursday at Owens-Illinois, 2500 Huntington Drive, Fairfield CA. Anyone interested in getting STUC should contact Dave or Steve Irwin at 422-3347.

LETTERS TO THE EDITOR

Oh-Oh

For October's article winner I vote for "Hurricane," page 84. This well-written article reflects a thorough job of programming. In fact, it is the first such article written for the TRS-80 Level II that actually ran in my machine without modification... timely, too, although Mr. Segar could hardly have foreseen "Fred" at the time he wrote and submitted the article for publication.

I have one suggestion, which you might like to pass on to your authors. Some of us who have been around for seventy, eighty or more years don't see fine details as we once did (I noticed it particularly at the beach this summer), and that fine print you use for the program listings is difficult for us at best. It's like this:

The letter O and the figure 0 have been in use for quite a spell, but even though I had three years of schooling, until I started playing around with computers I never realized that a zero was really nothing but a hungry O.

So, can you suggest that your contributors avoid the use of the letter O for variables? Maybe a D or a Q? These latter could still provide debugging experience, but it wouldn't be as boring.

A. R. Taylor
Gravette AR

I have received numerous letters regarding my "Hurricane" article and have been pleased regarding the "worked the first time" comments. The "Hurricane" program listing you published is correct; however, I did learn one valuable secret, which I

suggest you pass on to your future authors. Never use the letter O as a variable, especially when using BASIC shorthand in a program. When printed without the slash, it is difficult, unless you look closely, to tell the difference between the letter O and zero. One reader misinterpreted the zeros in lines 200 and 201 for variable Os. In doing so he completely changed the statement. I also left out the THEN portion of the IF/THEN statement. This is allowable in Radio Shack Level II BASIC shorthand and probably also led to his confusion. Lines 200 and 201 are easier to understand if written as follows:

```
200 IF L>0 THEN R=1  
201 IF L<0 THEN R=0
```

Without these lines, the program definitely won't work in all quadrants of the globe.

I discovered one other interesting "quirk," which I will pass on. Although they look much alike, the constant 1.5708 used in lines 310, 350 and 410 is not the same as the constant 1.5708 used in line 470. 1.5708 is used in the radian/degree conversion, while 1.5708 is used to convert nautical miles to statute miles.

Bryce D. Segar
Ft. Douglas UT

Scientific Applications

We hear more and more about the business revolution caused by the microcomputer. Magazines such as *Microcomputing* are full of articles on business applications and advertisements for business-oriented systems. Indeed, if we lightly read these pub-

lications we may get the impression that there are only three types of microcomputer users: 1. the hobbyist (a dying breed), who sits in the garage and plays with integrated circuits, but never really does anything with his machine; 2. the "home computer user," who uses his computer as a glorified video game, but has difficulty justifying it to his wife or the neighbors; 3. the business user, who uses the machine in his business, but who has trouble getting support from the manufacturers.

It sometimes seems that manufacturers and publishers are looking forward to that great day in the future when every mom-and-pop-type drugstore will have a computer in the back taking care of sales, billing, inventory, payroll and taxes. Since there are so many small businesses in the country, let's make all the computers to satisfy them, and just ignore all the other users. They're only hobbyists or educators (neither of whom have any money), so they don't matter.

I believe that the microcomputer manufacturers are overlooking scientific applications. Scientists and engineers are already among the larger users of mainframes in the U.S. today. A look at the equipment manufacturers' ads in *Physics Today* will show that about a third of the equipment manufactured is something that contains a dedicated microprocessor. And scientists have money to spend on equipment, too.

Scientific computers ordinarily perform three functions (two of them not dissimilar to functions performed by "business" computers): analysis of data and stor-

age of information. We can use text editing, too. The only real point of difference between "scientific" computers and "business" computers is that scientists like to use the machine for direct data acquisition.

To my knowledge, the only mainframe manufacturer seriously addressing the problem of the scientific user is Digital Equipment Corporation. My own microcomputer is an SWTP 6800 with 24K of memory, dot matrix printer, Kansas City Standard cassette interface and drive, 5 1/4" disk driver with DOS, plotter, 256 x 256 graphics and an 8-channel, 8-bit ADC with a 50 microsecond conversion time. I have half again the memory and can load programs from cassette three times as fast.

All this is the result of a cash outlay of about \$3000. If I were to include the cost of my time for construction of the graphics interface and all of the programming I had to do, it would probably raise that to about \$7000. But most of what I had to do was reinvent several wheels.

Dr. Gordon W. Wolfe
Asst. Prof., Physics/Astronomy
University of Mississippi

Epistolary Correspondence on Polysyllabification

Well, I just read Mits Hadeishi's letter (November 1979), and I was moved to write.

He's right! What kind of a title is "Microcomputing"? A lot of people can't even pronounce it! What's so bad about 1000 bits per second? People didn't understand

it? So why change to something more egregious?

73 has a good name. It's related to ham radio; it's *short* and easy to remember. Now we can do the same thing here without changing the name much—just call the magazine "Kilo." Remember: Ease of recognition of a name varies inversely with the number of syllables.

I don't care for the business-boxy cover photos. They look like U.S. Army tech manuals. How about pictures of kids with color graphics displays? Computer graphics displays? Something eye-catching? I think it looks better not to have the table of contents on the front; you have too many articles for something that important. However, the cover picture could be related to one of the articles inside. I think it's a good idea to have a thematic issue *now and then*, but not very often.

Please bring back *Kilobaud*. It's hard to advertise your mag (which is still the best) by word of mouth when the title is mike-ko-to-te-pring, or something like that.

Richard A. Rodman
Vienna VA

Still More

Try the circuit in Fig. 1 with David Morr's TTY program (August 1979 issue, p. 38).

John C. Rogers, Jr.
New Bedford MA

Ink Up and Start Typing

The article on the Centronics 779 Printer in the October 1979 issue was interesting and well written. I have had a Centronics 780 printer for a little more than one year now, and I have a tip I would like to pass along. My 780 has the same ribbon assembly as the Model 779. The only problem I have ever had with the ribbon is the short lifetime of the ink within it. Ribbons are too expensive to

Editor, KILBAUD Microcomputing
Pine Street
Peterborough, NH 03458

Dear Sir:

I like

kilobaud

Microcomputing

I also thought that having the complete table of contents on the front cover was a fine idea.

You do a great job between the covers.

Sincerely,

Lloyd L. Foster, Jr.
Lloyd L. Foster, Jr.
Instructor
Electronics Engineering Technology

replace very often, so I came up with a better solution.

For less than one dollar I bought a bottle of ink for re-inking pads. Now when my ribbon runs low on ink I simply apply some more ink to the top edge of the ribbon. I'm careful not to soak the ribbon too much.

I continue printing until the ribbon has made a complete pass through the ribbon cartridge, and then apply a little more ink to the top of the ribbon since what was on bottom is now on top. The pinch rollers help distribute the ink along the length of the ribbon so that by the third pass, it is like a new ribbon.

I have been using this method on the same ribbon for about ten months, and it currently shows no sign of wear, though I do not expect it to last forever.

By the way, does anyone else out there have an F-8 microprocessor system? Mine is called a Termdisk (it contains an eight inch floppy disk) and is manufactured by International Computer Products in Dallas. It is a

capable system even though it runs on an F-8. Anyone interested in F-8s, let me know. I doubt *Microcomputing* will ever print any articles on them.

Gary Fancher
204 Dee Lane
Arlington TX

Before we can print any F-8 articles, someone must write them. How about you, Gary?—Editors.

Gobble, Gobble, Gobble

Murphy was an optimist.

Else, why would a typo creep into Bill Harvey's October 1979 article, page 99, second column, third paragraph, where he is talking about his system. The typesetter, not believing his eyes, inserted an n, erroneously producing the word "turnkey." This is obviously an error since the next word is "home-built."

Surely, everyone except the typesetter knows that a turnkey system is one bought complete with all software and hardware, in one package, usually for one price, and most often for one particular application, ready to plug in and start processing data. The term probably stems from an analogy to an automobile purchase where you pay your money, turn the key and drive away.

If the application is BASIC programming, then some turnkey

systems are the PET, the TRS-80, the Sorcerer and TI 99/4. But there's no way a "home-built" system can be a turnkey system. Obviously Mr. Harvey intended it to read as follows: "turkey home-built system."

Now, don't you understand? Murphy was an optimist!

D. A. Bishop
Austin TX

Both the editor who worked on the article, and the typesetter who set it, are former prison guards (who often had to restrain compulsive crank-letter writers from going berserk in the exercise yard and trying to hoe messages to the warden in the turf). Consequently, our editor and typesetter are still imbued with prison parlance and undoubtedly had their previous jobs in mind when they edited and set the article.—Editors.

Port Alright

As you know, one of the greatest obstacles to using a micro-computer in a business application is the lack of qualified hardware repair specialists and software consultants. I own a Sol with a Helios IV disk drive and have tried to obtain satisfactory service in the Houston area for several months—all to no avail. The local PTC dealer (at least until PTC's recent demise) proved to be totally incompetent and unprofessional.

A few weeks ago I noticed in your magazine an advertisement for Computer Port in Arlington TX offering software for the Sol. On a lark, I called them to find out more, and as with all good stories, there was a happy ending.

I was invited to their offices to have my system repaired (it had been down for 16 weeks at the local dealer) and to consult with them on my specific software problems. In two days my entire system was not only repaired, but upgraded as well. Their service department was remarkable in that they were able to perform repairs on both drives, which, according to all information available in Houston, required service in California.

I just thought you might like to know that there are some good people around who support the efforts and standards of your magazine, and who can perform the same.

Kenneth J. Edwards III
Houston TX

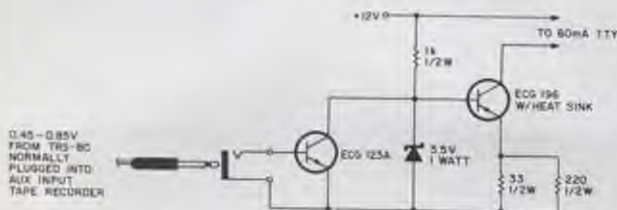
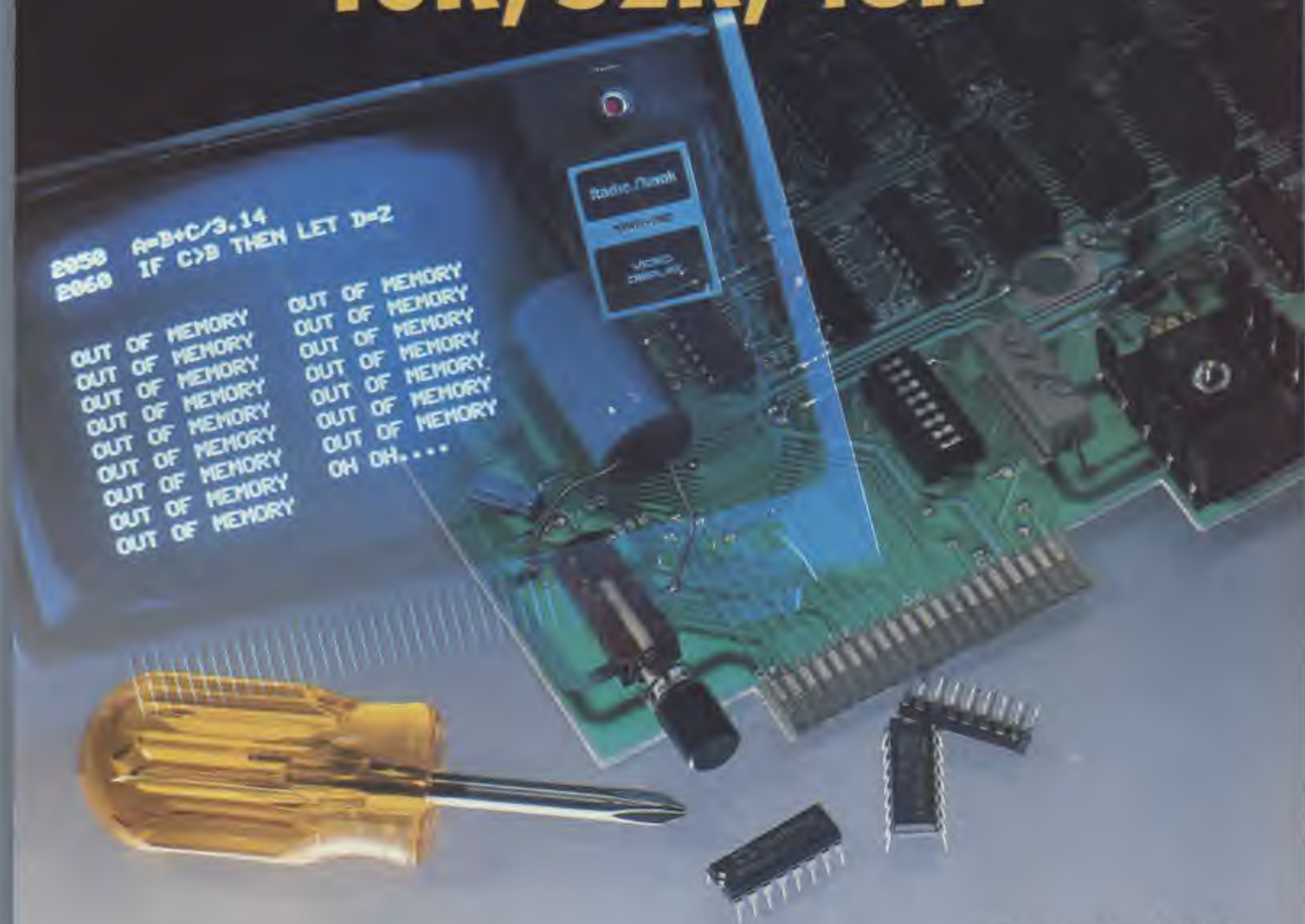


Fig. 1.

Memory Shortage Cures: 16K, 32K, 48K



The Product. Only high quality, prime, burned-in and tested 4116 16K dynamic RAMs. Don't be caught unaware! All TRS-80 memory expansion kits are not the same. UHF Associates' memory expansion gives you high quality coupled with outstanding performance. And with their fast 200 NS minimum access time (less CPU wait states) UHF's 4116 16K dynamic RAMs provide both storage and speed that won't disappoint you later down the road.

The Price. 16K Memory Expansion Kit for either computer (pre-programmed DIP shunts included) or expansion interface, \$95. More? 32K Kit for expansion interface, \$180. Most? 48K Kit for computer and expansion interface, \$265.

The Promise. "Thou shalt not wait, worry or fret." You'll get immediate post-paid delivery from in-stock inventory. You'll get a full 12 month warranty. That's about four times the warranty others offer. And for installation, you'll get UHF's "goof-proof" instructions. All you'll need is a screwdriver and about 10 minutes.

TRS-80 is a registered trade mark of Tandy Corporation.

Dealer Inquiries Invited

- | | |
|-------------------------------------------------------------------------|-------|
| <input type="checkbox"/> 16K Kit with shunts (for computer) | \$ 95 |
| <input type="checkbox"/> 16K Kit (for expansion interface) | \$ 95 |
| <input type="checkbox"/> 32K Kit (for expansion interface) | \$180 |
| <input type="checkbox"/> 48K Kit (for computer and expansion interface) | \$265 |

California residents please add appropriate sales tax

Name (print) _____

Street _____

City _____ State _____ Zip _____

☐ I've enclosed a check or money order for \$ _____ payable to **UHF Associates.**

We honor: ☐ Master Charge ☐ VISA/BankAmericard

Account # _____

Expiration Date _____

Signature _____

(required for charge card purchases)

U14



90 Transport Avenue, #4
Rohnert Park, CA 94928
Call 707/584-7844

NEW PRODUCTS

Edited by Dennis Brisson

Video Display Terminal

The InterTube II Video Display Terminal has recently been upgraded with the addition of a new version of software—version 1.7—which enables several new user-oriented editing features such as erase-to-end-of-line and page. Standard features of the InterTube include an upper and lowercase character set on an 8 × 10 dot matrix, a full 24 line by 80 character screen; a status line that displays the operating mode of the terminal and a complete ASCII typewriter-style keyboard with an 18 key numeric pad. The terminal includes a hooded display to cut down on glare and give extra privacy. A wide bandwidth monitor provides sharp images everywhere on the screen with below-the-line character descenders to make reading easier. Price is \$995.

Intertec Data Systems Corporation, 2300 Broad River Road, Columbia SC 29210. Reader Service number I21.

Smart CRT Terminal

The ADM-31 smart terminal offers two full 1920 character pages of display with independent page characteristics of Protect, Write/protect, Program mode and cursor retention. If the operator changes to another page, the attributes are automatically stored in memory and are re-

called exactly as they were originally when the page is read-dressed. The microprocessor-based ADM-31 is completely self-contained and comes equipped with keyboard, control logic, character generator, refresh memory and interface. The terminal's keyboard is integrated with main logic and can generate a full 128 ASCII character set. A numeric keypad is also included.

Full editing capabilities allow the user to clear the screen, use a destructive cursor for character change, skip protected fields, backspace, move up, down, return, home and new line. The ADM-31 features a high-resolution, 12-inch diagonal display screen with 24 lines of 80 characters in a 7 × 9 dot matrix. Price is \$1450.

Lear Siegler, Inc./Data Products Division, 714 N. Brookhurst, Anaheim CA 92803. Reader Service number S127.

32K RAM for the H8

The DG-32D is a 32K RAM board for Heath H8 computers. Designed to operate either with or without the present static memory in the computer, the DG-32D is ready to plug into the H8 and use without additional wiring. It consumes less than 6 Watts power. Features include: full compatibility with current Heath peripherals, circuit protection to prevent damage to memory output buffers if two blocks are assigned to the same address space, mem-



The ADM-31.

ory addressing controlled by DIP switch and transparent refresh. Price is \$479, assembled, tested and burned-in.

D-G Electronic Developments Co., PO Box 1124, Denison TX 75020. Reader Service number D70.

PET Graphic Display Board

The K-1008A-P Visible Memory is a high-resolution graphic display board that upgrades the Commodore PET computer system to permit high-resolution graphics. During image update

there is no snow or visible interference. When not used for graphics, the board serves as an 8K byte expansion memory, doubling the 8K PET capacity. K-1008-3C graphic software (\$20) is also offered.

The display board puts up a high-resolution matrix of 64,000 dots (320 wide × 200 high) and allows control of the on/off state of each dot individually and independently. The board interfaces to the PET with the K-1007A-1 bus adapter (\$99) with easily detached ribbon cable interconnects. Without bus adapter, the K-1008A-P can be used with AIM-65, KIM-1 and SYM-1 computers. The K-1005A-P expan-



The InterTube II.



Upgrading the PET with the K-1008A-P.

sion card file (\$80) is optional. Price is \$243.

Micro Technology Unlimited, PO Box 4596, Manchester NH 03108. Reader Service number M44.

Apple II Joystick

The PAIA/Apple II Joystick Controller features plug-in compatibility with Apple II's game I/O connectors, precision-gimbaled self-centering action and case style and color consistent with the Apple II. Other features include front-panel trimmers for x- and y-axis outputs and a capacitively activated closure to the Apple II's SW0 input which operates with a finger's touch of the controller's metal shaft. Closure to Apple II's SW1 input is activated with a standard push button. Price is \$65.

PAIA Electronics, Inc., 1020 Wilshire Blvd., Oklahoma City OK 73116. Reader Service number P9.

Double-Density Floppy Disk Interface

The Tarbell Double-Density Floppy Disk Interface enhances existing disk storage capacities with only minimum reconfiguration of existing microcomputer systems. The interface board is supplied with the new BASIC Input/Output System (BIOS) software for CP/M on single-density diskette, permitting the user to intermix single- and double-density diskettes. The Tarbell system automatically determines whether

single or double density is in use. As many as four drives, using either single or double density, can be selected.

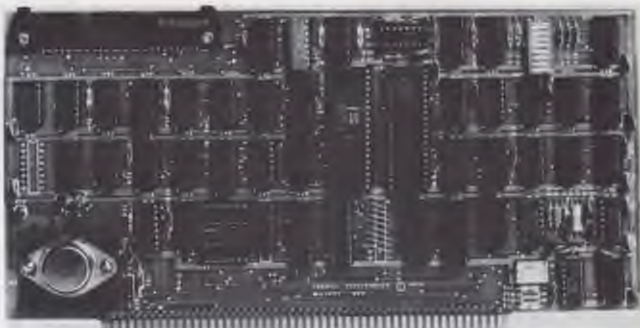
The 8 inch Shugart-compatible disk interface contains phase-lock loop and write precompensation, providing more reliable data storage and recovery. The on-board phantom bootstrap PROM is disabled on completion of the bootstrap operation, freeing all 64K of memory address space for other use. Multi-user operation is now possible. Extended addressing capability provides eight additional address bits, allowing direct transfers to and from any location within a 16 megabyte address range. Price is \$425.

Tarbell Electronics, 950 Doven Place, Suite B, Carson CA 90746. Reader Service number T11.

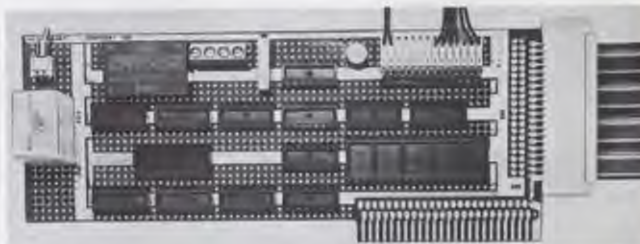
S-100 6809 CPU Card

The MD-690b CPU card brings the 6809 processor to the S-100 bus. This single-board computer integrates I/O, RAM, PROM cassette interface and other features in a complete package for instant use. With the MD-690b you have your choice of two different monitor PROMs. MONBUG II provides the firmware you need to interface to memory-mapped video cards such as the VB1-B and MicroDaSys' full-color, 80 x 24 ColorMaster video card. RSBUG II enables the user to interface directly to an RS-232 terminal using the board's own hardware.

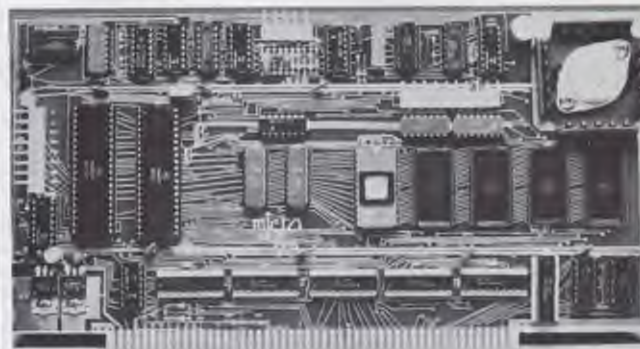
Features include an on-card 2400 baud (Manchester encoded)/300 baud (KC Standard) cassette



Tarbell's double-density floppy disk interface.



Model 4609.



The MD-690b CPU card.

interface, 1K static RAM, 10K PROM space, RS-232 level shifters, an interrupt-driven keyboard input, 20 I/O lines, power-on reset, DMA capability, interrupt handling and real-time clock. Prices are \$239 (kit) and \$299 (assembled and tested).

MicroDaSys, PO Box 36051, Los Angeles CA 90036. Reader Service number M110.

Interface Board for Apple and PET

The Model 4609 is a new peripheral interface board that is compatible with Apple II and Superkim microcomputers without any special adapter unit, as well as with the PET Commodore

unit, provided an adapter unit called Expandamem has been installed in it. The board has provisions for extended board area and dual heavy-duty power buses between the DIP IC leads for easy, short bus connections. The 4609 is designed for construction of special control, communications, peripheral or memory interface circuits using support devices by major semiconductor manufacturers, as well as for breadboarding experimental circuits.

Three connectors, in addition to the standard 25/50 system bus, are available for input/output. A 20/40-contact card-edge connector, fabricated on the rear of the board, mates with a 3-M-type ribbon connector. Alternatively, a right-angle solder-tail header may be positioned in this same location. The Model 4609 also ac-



PAIA's joystick for Apple II.



The TNW-2000.

commodates the miniature SIP-type connectors, which may be placed on the periphery or in mid-board. Price is \$21.50.

Vector Electronic Co., Inc., 12460 Gladstone Ave., Sylmar CA 91342. Reader Service number V8.

Serial Interface

Now you can interface your computer to standard RS-232 printers, terminals, modems and other computers with the TNW-2000 Serial Interface, which adds a bidirectional RS-232 port to the Commodore PET and other IEEE-488 computers.

You can set the baud rate from 110 to 9600 bits per second and switch-select the IEEE bus address, data word length/parity (8-bit words without parity or 7-bit words with even or odd parity) and operation with either 115 V or 230 V 50/60 Hz power sources (power supplies are built in). Enabling automatic conversion between the (old style) PET and ASCII character sets for both input and output is also possible.

Other devices can be used on the IEEE bus with the TNW-2000. A 1 meter IEEE bus cable provides a daisy-chaining capability

with both the PET-style edge-board connector and the IEEE-488 standard ribbon connector. Price is \$229.

TNW Corporation, 3351 Hancock Street, San Diego CA 92110. Reader Service number T56.

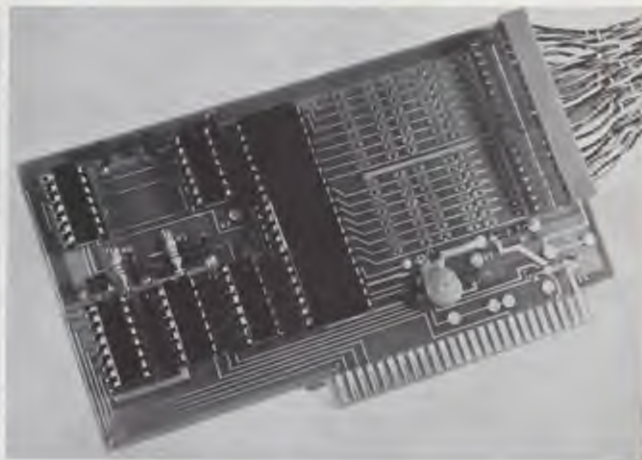
TRS-80 Power Supply

Mayday is an uninterruptible power supply that keeps your computer on—and thus saves your program and data from being lost—when the power fails. It provides instant power switch-over when a power outage occurs and protects from any ac line surges due to neighboring large current changes. Especially designed for the TRS-80, Mayday can handle the complete business system of video, expansion interface, CPU and four disk drives for about one-half hour of power outage; nonbusiness systems will hold for about one hour. It will also handle other microcomputers that have about 140 Watts power consumption; 250 Watt capability is also available.

Mayday maintains charge on the standby battery during normal usage and is always ready for use, no matter when the line voltage fails. Accessories include



Mayday.



The AI-02.

a battery and line surge protector.

Sun-Technology, Inc., Box 210, New Durham NH 03855. Reader Service number S126.

Apple Analog Input Card

The AI-02 Analog Input Card provides a single-card data acquisition system for Apple II computers. Sixteen analog channels may be monitored by the system

with 8-bit resolution. Channels are individually addressable, and conversion time is 70 microseconds. The system can be operated from BASIC and also provides interrupt capability for more efficient software implementation. The AI-02 is suited to such applications as temperature sensing and process control.

Interactive Structures, Inc., Suite 204, 3401 Science Center, Philadelphia PA 19104. Reader Service number I49.

Also, see pages 188 and 189 for new software releases.

CONTEST!

Winner of the "best article of the month" for October is Allan J. Domuret, author of "Expanded TRS-80 Operations."

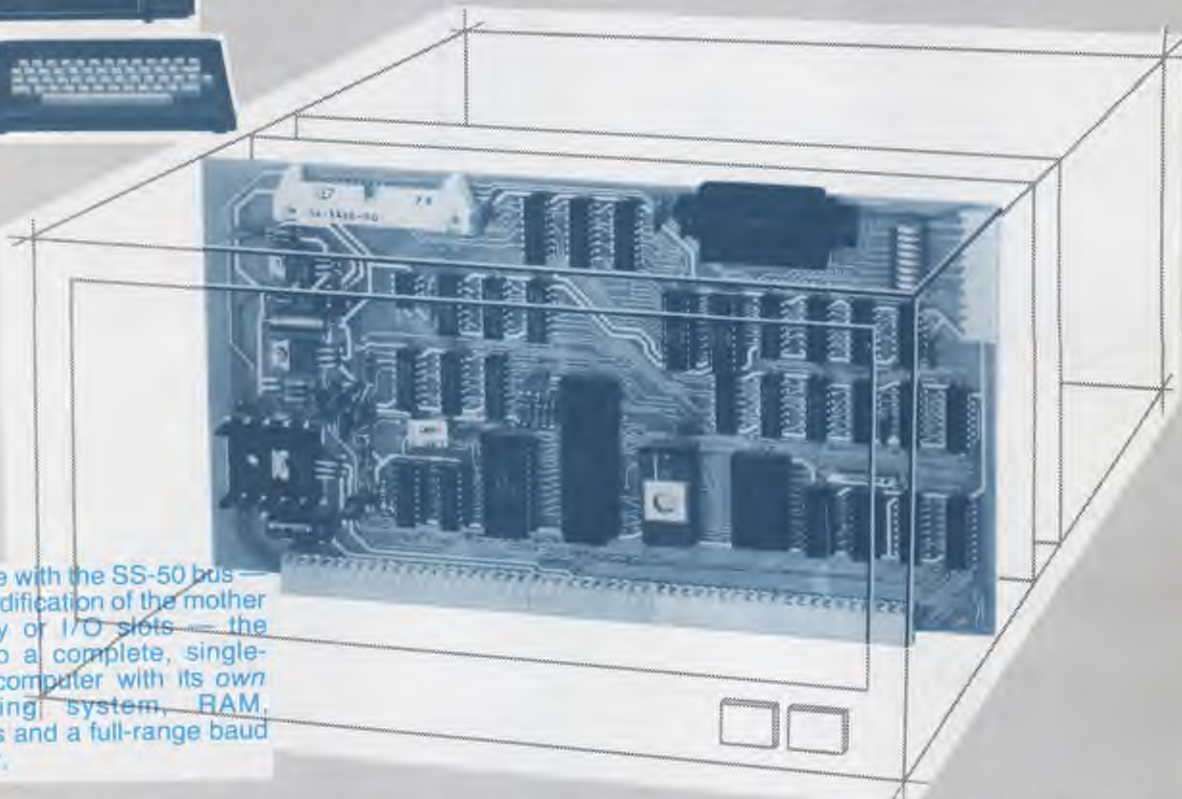
Winner of a lifetime subscription to *Microcomputing* is C. A. Lopez of El Paso, Texas. Choice of a book from the Book Nook goes to Saul G. Levy of Tucson, Arizona.

Congratulations to everyone.

One of your responsibilities, as a reader of *Kilobaud MICROCOMPUTING*, is to aid and abet the increasing of circulation and advertising, both of which will bring you the same benefit: a larger and even better magazine. You can help by encouraging your friends to subscribe to *Kilobaud MICROCOMPUTING*. Remember: Subscriptions are guaranteed—money back if not delighted, so no one can lose. You can also help by tearing out one of the cards just inside the back cover and circling replies you'd like to see: catalogs, spec sheets, etc. Advertisers put a lot of trust in reader requests for information. To make it more worth your while to send in the card, a drawing will be held each month and the winner will get a lifetime subscription to *Kilobaud MICROCOMPUTING*!

6809 PROCESSING POWER!

The Percom SBC/9™. Only \$199.95.



Fully compatible with the SS-50 bus—requiring no modification of the mother board, memory or I/O slots—the SBC/9™ is also a complete, single-board control computer with its own ROM operating system, RAM, peripheral ports and a full-range baud clock generator.

Make the SBC/9™ the heart of your computer and put to work the most outstanding microprocessor available, the 6809.

the Mighty 6809

Featuring more addressing modes than any other eight-bit processor, position-independent coding, special 16-bit instructions, efficient argument-passing calls, autoincrement/autodecrement and more, it's no wonder the 6809 has been called the "programmers dream machine."

Moreover, with the 6809 you get a microprocessor whose programs typically use only one-half to two-thirds as much RAM space as required for 6800 systems, and run faster besides.

And to complement the extraordinary 6809, the Percom design team has developed PSYMON™, an extraordinary 6809 operating system for the SBC/9™.

PSYMON™ — Percom SYstem MONitor

Although PSYMON™ includes a full complement of operating system commands and 15 externally callable

™ trademark of Percom Data Company, Inc.

utilities, what really sets PSYMON™ apart is its easy hardware adaptability and command extensibility.

For hardware interfacing, you merely use simple, specific device driver routines that reference a table of parameters called a Device Control Block (DCB). Using this technique, interfacing routines are independent of the operating system.

The basic PSYMON™ command repertoire may be readily enhanced or modified. When PSYMON™ first receives system control, it initializes its RAM area, configures its console and then 'looks ahead' for an optional second ROM which you install in a socket provided on the SBC/9™ card. This ROM contains your own routines that may alter PSYMON™ pointers and either subtly or radically modify the PSYMON™ command set. If a second ROM is not installed, control returns immediately to PSYMON™.

- Provision for multi-address, 8-bit bidirectional parallel I/O data lines for interfacing to devices such as an encoded keyboard.
- A serial interface Reader Control output for a cassette, tape punch/reader or similar device.
- An intelligent data bus: multi-level data bus decoding that allows multiprocessor and bus multiplexing of other bus masters.
- Extended address line capability — accommodating up to 16 megabytes of memory — that does not disable the on-board baud rate clock or require additional hardware in I/O slots.
- On-board devices which are fully decoded so that off-card devices may use adjoining memory space.
- Fully buffered address, control and data lines.

The SBC/9™, complete with PSYMON™ in ROM, 1K of RAM and a comprehensive users manual™ costs just \$199.95.

PERCOM

PERCOM DATA COMPANY, INC.
211 N. KIRBY GARLAND, TEXAS 75042
(214) 272-3421

✓ P82

To place an order or request additional literature call toll-free 1-800-527-1592. For technical information call (214) 272-3421. Orders may be paid by check, money order, COD or charged to a VISA or Master Charge account. Texas residents must add 5% sales tax.

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Percom 'peripherals for personal computing'

Welcome to Percom's Wide World

SS-50 Bus LFD-400™ and LFD-800™ Systems



Each LFD mini-disk storage system includes:

- drives with integral power supplies in an enamel-finished enclosure
- a controller/interface with ROM operating system plus extra ROM capacity
- an interconnecting cable
- a comprehensive 80-page users manual

Low-Cost Mini-Disk Storage in the Size You Want.

Percom LFD mini-disk drive systems are supplied complete and ready to plug in the moment they arrive. You don't even have to buy extra memory. Moreover, software support ranges from assembly language program development aids to high-speed disk operating systems and business application programs.

The LFD-400™ and -400EX™ systems and the LFD-800™ and -800EX™ systems are available in 1-, 2- and 3-drive configurations. The -400, -400EX drives store 102K bytes of formatted data on 40-track disks, and data may be stored on either surface of a disk. The -800, -800EX drives store 200K bytes of formatted data on 77-track disks.

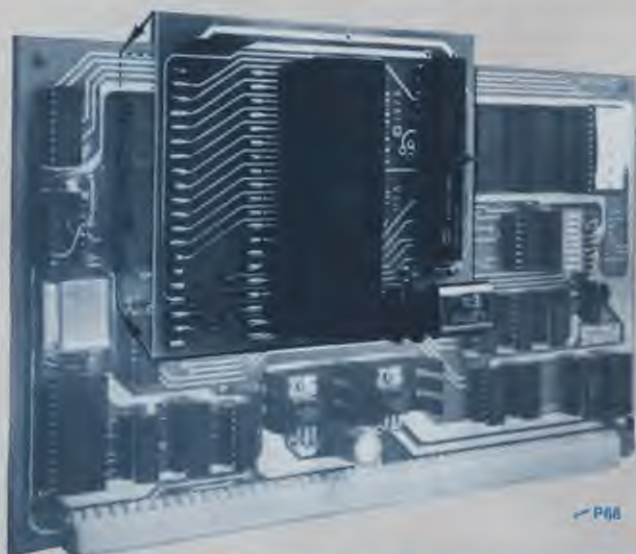
The LFD-1000™ systems (not pictured) have dual-drive units which store 800K bytes on-line. The LFD-1000™ controller accommodates two drive systems so that a user may have as much as 1.6M bytes on-line.

Mini-disk storage system prices:

MODEL	1-DRIVE SYSTEM	2-DRIVE SYSTEM	3-DRIVE SYSTEM
For the SS-50 Bus:			
LFD-400™	\$ 599.95	\$ 999.95	\$1399.95
LFD-800™	895.95	1549.95	2195.95
For the EXORciser® Bus:			
LFD-400EX™	\$ 649.95	\$1049.95	\$1449.95
LFD-800EX™	945.95	1599.95	2245.95
LFD-1000™	(dual) \$2495.00	(quad) \$4950.00	—



EXORciser® Bus LFD-400EX™, -800EX™ Systems



Upgrade to 6809 Computing Power. Only \$69.95

Although designed with the SWTP 6800 owner in mind, this upgrade adapter may also be used with most other 6800 and 6802 MPUs. The adapter is supplied assembled and tested, and includes the 6809 IC, a crystal, other essential components and user instructions. Restore your original system by merely unplugging the adapter and a wire-jumpered

DIP header, and re-inserting the original components. Also available for your upgraded system is PSYMON™ (Percom System MONitor), the operating system for the Percom 6809 single-board computer. PSYMON™ on 2716 ROM costs only \$69.95. On diskette (source and object files), only \$29.95.

Data Terminal & Two-Cassette Interface — the CIS-30+



- Interface to data terminal and two cassette recorders with a unit only 1/10 the size of SWTP's AC-30.
- Select 30, 60 or 120 bytes per second cassette interfacing; 300, 600 or 1200 baud data terminal interfacing.
- Optional mod kits make CIS-30+ work with any microcomputer. (For MITS 680b, ask for Tech Memo TM-CIS-30+-09.)
- KC Standard/Bi-Phase-M (double frequency) cassette data encoding. Dependable self-clocking operation.
- Ordinary functions may be accomplished with 6800 Mikbug® monitor.

Prices: Kit, \$79.95; Assembled, \$99.95. Prices include a comprehensive instruction manual. Also available: Test Cassette, Remote Control Kit (for program control of recorders), IC Socket Kit, MITS 680b mod documentation and Universal Adapter Kit (converts CIS-30+ for use with any computer).

of 6800 Microcomputing.

6800/6809 SOFTWARE

System Software

6800 Symbolic Assembler — Specify assembly options at time of assembly with this symbolic assembler. Source listing on diskette \$29.95

Super BASIC — a 12K extended random access disk BASIC for the 6800 and 6809. Supports 44 commands and 31 functions. Interprets programs written in both SWTP 8K BASIC (versions 2.0, 2.2 & 2.3) and Super BASIC. Features: 9-digit BCD arithmetic, Print Using and Input commands, and much more. Price \$49.95

TOUCHUP — Modifies TSC's Text Editor and Text Processor for Percom mini-disk drive operation. Supplied on diskette complete with source listing \$17.95

Operating Systems

INDEX — This easy-to-use disk-operating and file management system for 6800 microcomputers is fast. I/O devices are serviced by interrupt request. INDEX[™] accesses peripherals the same as disk files — new devices may be added without changing the operating system. Other features: unlimited number of DOS commands may be added • over 60 system entry points • display only those files at or above user-specified file activity level • versions available for SWTP MF-68, Smoke's BFD-68 and Motorola's EXORCISER*. Price \$99.95

MINIDOS-PLUSX — An extension of the original MINIDOS[™] for LFD-400[™] mini-disk systems. MINIDOS-PLUSX[™] manipulates files by six-character names. Supports up to 31 files. Resident commands include Initialize, Save, Allocate, Load, Files (directory list), Rename and Delete. Supplied on 2708 ROM with a minidiskette that includes transient utilities such as Copy, Backup, Create, Pack and Print Directory. Price \$34.95

PSYMON — Percom SYSTEM MONITOR for the Percom single-board/SS-50-bus-compatible 6809 computer accommodates user's application programs with any mix of peripherals without modifying programs. PSYMON[™] also features character echoing to devices other than the communicating device, sophisticated register and memory dump routines and more. Price (on 2716 ROM) \$69.95

WINDEX — Described in detail elsewhere on this page.

Business Programs

General Ledger — For 6800/6809 computers using Percom LFD mini-disk storage systems. Requires little or no knowledge of bookkeeping because the operator is prompted with non-technical questions during data entry. General Ledger updates account balances immediately — in real time, and will print financial statements immediately after journal entries. User selects and assigns own account numbers; tailors financial statements to firm's particular needs. Provides audit trail. Runs under Percom Super BASIC. Requires 24K bytes of RAM. Supplied on minidiskette with a comprehensive users manual. Price \$199.95

FINDER — This general purpose data base manager is written in Percom Super BASIC. Works with 6800/6809 computers using Percom LFD-400[™] mini-disk drive storage systems. FINDER[™] allows user to define and access records using his own terminology — customize file structures to specific needs. Basic commands are New, Change, Delete, Find and Pack. Add up to three user-defined commands. FINDER plus Super BASIC require 24K bytes of RAM. Supplied on minidiskette with a users manual. Price \$99.95

Mailing List Processor — Powerful search, sort, create and update capability plus ability to store 700 addresses per minidiskette make this list processor efficient and easy to use. Runs under Percom Super BASIC. Requires 24K bytes of RAM. Supplied on minidiskette with a users manual. Price \$99.95

From the Software Works

Development and debugging programs for 6800 μ Cs on diskette:

Disassembler/Source Generator	..... \$30.95
Reloc'ing Disas'mbr/Segmented Text Gen	..... \$40.95
Disassembler/Trace	..... \$25.95
Support Relocator Program	..... \$25.95
Relocating Assembler/Linking Loader	..... \$55.95
SmithBUG** (2716 EPROM)	..... \$70.00

1/2-Price Special on Hemenway Software!

CP/68 [†] disk operating system	..... \$ 49.97
STRUBAL+ [‡] compiler	..... \$124.97
EDIT68 text editor	..... \$ 19.97
MACRO-Relocating Assembler	..... \$ 39.97
Linkage Editor (LNKEDT68)	..... \$ 24.97
Cross Reference utility	..... \$ 14.97

*Trademark of Percom Data Company, Inc.

†Trademark of Motorola Corporation

‡Trademark of Hemenway Associates Company

**SmithBUG is a trademark of the Software Works Company

And 'looking into' is just what you do with the Electric Window[™] as you peer right into memory space where characters are being input and manipulated. Display is memory-resident, programmable and generates up to 24 80-character lines.

Other features include:

- standard character generator plus provision for optional special character generator
- dual intensity, high-lighting alphanumeric display
- scrolling by a programmable register • programmable display positioning
- programmable interlaced or non-interlaced scan
- descenders on lower case letters • users manual with application instructions and listing of WINDEX[™] driver.



The Electric Window.[™] Worth Looking Into. \$249.95

WINDEX[™] is a fast video display driver program for the Electric Window[™]. WINDEX[™] also features: program and keyboard control of character generators • displayable control characters — under program control • automatic scrolling • a driver routine for the parallel input keyboard feature of the Percom 6809 Single-Board Computer, the SBC/9[™] • auto-linking to PSYMON[™], the ROM operating system for the SBC/9[™] • Prices: ROM version: \$39.95; LFD-400[™] compatible diskette (source and object files): \$29.95.

Now Available! the SBC/9[™] MPU/Control Computer

(Single-Board-Computer/6809) — stands alone as a control computer, but also compatible with the SS-50 bus for use as an MPU card. Includes PSYMON[™] (Percom SYSTEM MONITOR) in a 1K ROM and provides for additional 1K of ROM. Also includes 1K of RAM. Features: Super Port — provision for multi-address, 8-bit bidirectional data lines • an intelligent data bus for multi-level data bus decoding • an on-board 110-baud to 19.2 kbaud clock generator • extended address capability — to 16 megabytes — without disabling baud clock or adding hardware. And much more. Supplied with PSYMON[™] and comprehensive users manual. Price \$199.95.

See full page ad elsewhere in this magazine for all of the SBC/9[™] features.

Full Feature Prototyping PC Boards

All of the features needed for rapid, straightforward circuit prototyping. Use 14-, 16-, 24- and 40-pin DIP sockets • SS-50 bus card accommodates 34- and 50-pin ribbon connectors on top edge, 10-pin Molex connector on side edge • I/O card accommodates 34-pin ribbon connector and 12-pin Molex on top edge



I/O Bus Card: \$14.95



SS-50 Bus Card: \$24.95

- I/O card is 1-1/4 inches higher than SWTP I/O card • interdigitated power conductors • contacts for power regulators and distributed capacitance bypassing
- use wire wrap, wiring pencil or solder wiring • tin-lead plating over 2-oz copper conductors wets quickly, solders easily
- FR4-G10 epoxy-glass substrate.

To place an order or request additional literature call toll-free 1-800-527-1592. For technical information call (214) 272-3421. Orders may be paid by check, money order, COD or charged to a VISA or Master Charge account. Texas residents must add 5% sales tax.

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

PERCOM

PERCOM DATA COMPANY, INC.
211 N. KIRBY GARLAND, TEXAS 75042
(214) 272-3421

Dial-up Directory

Computer bulletin board services are everywhere. To join the fun of instant information exchange, you'll need a terminal, a telephone and a modem (like the one described on p. 52).

Frank J. Derfler, Jr.
PO Box 17283
Montgomery AL 36117

The hallways of companies in the computer industry ring with phrases such as "distributed processing" and "smart terminals." Megadollar corporations are modifying their management structures to take advantage of the synergistic relationship between computers and communications. Flashy executives and congressmen too consider it a "perk" (nontaxable) to be able to dial into their mailboxes from a portable terminal and sort through their old and new messages. Military communications planners talk about many network terminals sharing a "data base in the sky." There is no reason why those of us with our own microcomputers can't participate in the exciting world of digital information transfer just like the megabuck boys.

Introduction

This is the start of a new *Microcomputing* feature called the Dial-up Directory. The Dial-up Directory will have two purposes: to provide (1) an annotated directory of those computer bulletin board services (CBBS) that exist around the country and of those individuals interested and capable of exchanging data by phone and (2) information on software and systems that can give you a dial-up capability.

We all have different interests and ways of utilizing our computers. Often our interests and requirements are not shared by local individuals or clubs. It is extremely helpful to be able to share programs and suggestions via data phone calls from around the country.

**We would like to publish
the name and phone
number of anyone
presently interested in
receiving data calls.**

Whether your interests are graphics on the Apple, games on the PET, number crunching on the North Star or computer-assisted instruction on the TRS-80, there are others out there similarly inclined. We will try to hook you up.

We will have a lot of work to do together. We will have to work out and spread the word not only on electronic protocols, but also on those human protocols that exist whenever people interact with one another. We will describe ideal ways of doing things, the cheap way of doing things and the road down the middle. First, though, let's describe the world we

will be looking at for those who may not be familiar with it.

Getting Started

Almost all of the computers we own have a practical communications capability of one sort or another. The cassette recorder port on most machines is one example.

The main I/O capability we are interested in is the RS-232 ASCII port available either stock or as an accessory on almost every microcomputer. Cassette and disk formats may differ between brands of computers and, indeed, even between models of the same brand, but the RS-232 ASCII port brings everything out in a common electrical medium of exchange. My OSI can talk to your TRS-80 at a useful speed, and we can exchange programs and information over a communications link.

Probably the best (but certainly not the only) communications medium we have between us is the telephone line. The U.S. still has the best overall phone system in the world (Japan and some sections of the Middle East are coming up fast), and the telephone represents an economical way of sending our minds out around the country.

In order to convert and send the digital plus and minus voltages of the RS-232 signal over the phone lines, we need a device called a modem, which converts these dc voltages into audio

From:	EDST	EST/ CDST	CST/ MSDT	MST/ PDST	PST	HST AST
To GMT						
Add:	+4	+5	+6	+7	+8	+10
Hours						

Table 1. Conversion from local to Coordinated Universal Time (GMT).

tones. The tones are received by a modem at the distant end and converted back into dc. The Bell system set the standards for low-speed (to 300 baud) modems; their Bell 103A standard is typically used. Under this standard, each party (one called the "originate" and one called the "answer") uses a different set of tones.

This means that if I wanted to call you to send you the nifty program that I just wrote to water my vegetable garden, we would first have to verbally agree on the speed (110 and 300 baud are the most common) and on which one of us would use the originate signaling tones and which one would use the answer tones. Then we would connect our modems to our phones and send data.

Obviously, one of us would have to have a modem capable of operating in the answer mode. This is important, because as you read modem ads you should look for the capability you need. Many modems are originate only. Many others advertise themselves as originate/answer but don't make it clear that the option requires extensive rewiring. "Switchable originate/answer" is the key phrase for complete flexibility.

Potential Difficulties

Establishing contact by phone probably only means you are over the hardware hurdle. Another favorite buzz phrase in large system procurement today is that hardware is easy . . . it's software that's difficult. Once you receive my data on your system, what can you do with it? With the right software, your system can save it on disk or tape to recall and use again at your convenience. We will talk about software to do that in future articles.

Without the right software, you can only print out the data you receive. But at least you have a hard copy to refer to. If your computer acts only as a "dumb terminal," then you can probably have a nice chat, but you may have only a few scribbled notes to remember it by.

Other difficulties may be thrown into our exchange of data if I am not free to get on the phone at the same time you are. There are two ways around this: an auto answer capability to allow access with the terminal unmanned (after all, what good is automation if you can't put yourself out of a job?) and a store and forward service.

These services exist in many places around the country. They are typically known under the generic name of computer bulletin board services (CBBS). I can dial into this service (actually, anybody's system with an automatic answer modem, the right program, sufficient memory and a large electric bill), select the bulletins I want to read and leave a copy of my rutabaga-watering program.

In that way, you and everybody else on the system can review my program at your convenience. This is practically the ideal information exchange. Would you like to take part? That is the goal of this series.

The Directory

We would like to publish the name (use a pseudonym if you like, but no CB call signs, please) and phone number of anyone presently capable of and interested in receiving data calls. We will need any specifics or limitations, such as baud rate, answer only, special control codes or carriage returns. We need to know when and on what days you will be interested in receiving calls. We will also have room for information on interests—stock market analysis, for example.

One of our biggest services can be getting people with similar interests in touch with each other—digitally. Because of the various time zones in-

volved, I suggest we use Coordinated Universal Time (also known as GMT, Zulu or WWV time). A quick-reference GMT-to-local-time conversion chart is included in Table 1.

Remember: You may be getting calls from around the country, so it is only common courtesy to keep your 5-year-old from answering the phone during the times you specified, and it might be nice to not answer at all if you are not interested or able to transfer data on a specific day. A firm promise to return the call at another time is probably the least you owe someone who called you in good faith. An automatic audio answering device such as a Code-a-phone will allow recording up to 30 seconds of received data. We'll also discuss transferring data from the Code-a-phone to the computer in a later article.

In this introductory article, let me acquaint you with three excellent computer bulletin board services (see Directory). They represent a good starting point because they each contain extensive prompts and guides to make your telecommunications trials less terrifying. They are all available 24 hours a day, work either 110 or 300 baud and operate in the answer mode. They are free of any financial charge and don't need any passwords or codes, but that can all change if they are abused. The rules are just like those for a campground: keep it clean, don't leave any garbage behind and don't overstay your welcome, because others are waiting to use the facilities.

You can enter any of these systems by dialing the phone number, connecting your modem as soon as you hear the answering tones begin and sending at least three carriage returns. The host computer will read the carriage returns and reply at the proper speed. It is then that the fun begins.

Let me hear from you if you want to receive data calls or if you operate a CBBS. Send mail to PO Box 17283, Montgomery AL 36117, or leave a message on the Atlanta CBBS (404) 939-1520. ■

Location	Operated by	Phone
Dallas	Ric Martin and Bill Kennedy	(214) 641-8759
Atlanta	Les Freed	(404) 939-1520
Oregon	Jim Willing and Bill Marx	(503) 646-5510

Dial-up Directory.

Tiny Dual-Trace Oscilloscope

The micro-sized NLS MS215 scope is for microcomputer troubleshooting.

Nat Wadsworth
PO Box 3153
Milford CT 06460

I purchased my NLS MS215 dual trace oscilloscope at a local electronics distributor. It was in its original factory carton, which I opened at the distributor's counter to make sure that it came with probes. (It did, but with simple alligator clips at the working end!) I was unsure whether probes were included with the basic unit because some of the advertisements by mail-order suppliers indicated that scope probes were extra. The extra probes referred to in some ads, it turns out, are the fancy 10:1 probes many people like to use.

I also gave the unit a once-over glance while at the distributor's counter. However, I did not attempt to operate the unit at the point of purchase.

Inspection

When I got the unit home, I gave it a thorough visual inspection.

The only physical defect I could find was a tiny chip on one of the corners of a front panel slide switch. The flaw was big enough to notice but not sufficient to upset me. I don't think I would have passed the unit with such a defect if I were the quality-control man at the factory. On the other hand, I could understand a weary inspector missing the flaw if he or she had to examine hundreds of units per day as they came down the production line. After all, I had not noticed the imperfection during my once-over glance when I purchased the unit.

I was pleased with what I found in the manual. It is well written and sufficiently comprehensive. The 36-page booklet does a creditable job covering the basic aspects of how to use the instrument, discusses the theory of operation of the circuits used in the scope and describes calibration and maintenance procedures. This is all done on a much more thorough level than in the manuals for other pieces of gear that I have had the occasion to examine lately. The manual even includes a full schematic, printed

circuit board pictorials that include call-outs of active components and troubleshooting hints for each major section of the instrument's circuitry!

Power up

Time to turn the unit on and try it out. The instruction manual said to be sure the batteries were charged up first or else to run the scope off its ac adapter. I plugged in the adapter and gave it a few minutes to get some initial juice into its batteries per the manual's recommendations. Finally, it was time to turn the unit on.

After powering it up, I noticed an extremely high-pitched whistling noise. It was faint but clearly discernible. My first thoughts were that it might drive some people, particularly those sensitive to high-frequency sounds, slightly berserk. Fortunately, the sound is indeed very faint. I was alone in a completely quiet room when I first turned on the unit. Subsequent use has shown that just a slight amount of ambient noise, such as a softly playing radio, drowns out the high-pitched sound that emanates from the scope. The

noise apparently comes from the unit's power supply that utilizes digital switching techniques operating at frequencies that are barely detectable by people. (It may be interesting to see how a dog reacts to the unit. They apparently can hear higher frequencies than people, much more clearly.)

I also noticed that the scope trace was tilted. When viewed against the etched reference grid on the unit, the trace was about one-quarter of an inch higher at the left side of the display than at the right side. To me, there are few things more annoying when trying to read a scope than having the display run downhill (or any way but *straight*) across the display tube! It is disorienting, to say the least, and it makes it tough to do any kind of serious voltage measurements.

I can assure you I was not pleased with what I initially saw. I don't know if the particular unit I purchased left the factory in that condition. I certainly hope not. Perhaps jarring the unit during shipping caused the cathode ray tube to rotate slightly. In either case, the company might want to keep an eye on the problem. I don't think mine was an isolated case. I recently noted the same firm's model 15 scope on display at an electronics show. The signal being displayed was tilted in a noticeable manner. I wonder how many prospective customers were turned off.

It turns out that it is fairly simple to correct such a situation. The problem comes about from the cathode ray tube not being positioned correctly. Undoing a screw on the instrument's case permits the cabinet to be slid



This front view of the MS215 shows that all the essential controls are right up front where needed.

off. Doing so reveals the compact and neatly laid-out circuitry.

The miniature cathode ray tube is held at its base by a socket, which is mounted in a clamping arrangement. A single screw on the socket clamp applies pressure to the clamping mechanism that holds the socket. Backing off the screw allows the tube socket to be rotated, and the display can thus be adjusted so that a straight raster line runs horizontally.

After adjustment, retighten the clamping screw. The adjustment takes just a few minutes; however, it is annoying to have to do it. After all, the display is the essence of an oscilloscope. I think the factory would want to pay close attention to see that it was OK when shipped and that it stayed properly oriented during shipment. In all other respects the unit is fine. In fact, the little scope is ideal for my applications.

Specifications

While I did not make tests with precision equipment, it appeared that the equipment was within specifications. However, some of the specifications stated seemed to be merely an exercise in "specmanship."

For instance, the vertical calibration is stated to be within three percent of full scale. Full scale on this little scope is all of one inch. That means that if you are trying to measure a voltage that is one volt peak-to-peak, on a full-scale setting, the vertical distance might vary by three one-hundredths of an inch. Not many people can readily discern that difference on an oscilloscope of this size... nor should they try to!

Most of my work is with digital logic in microcomputer systems. Occasionally I need to check analog signals, such as when checking power supplies, A/D or D/A converters; and, once in a while, I will check out a radio or audio system. Being a dual trace oscilloscope, the MS215, is a real boon to me. I can put a system clock signal on one trace. I can then use the other trace to follow a signal path

through a logic network and check it directly against the system clock. Misbehaving counters, shift registers and just plain logic gates can't escape detection using this method.

The vertical sensitivity on each channel can be selected to be anywhere from 10 millivolts per division to 50 volts per division. This sensitivity selection is independent on each channel. It is set through a pair of switches. A four-position slide switch selects a sensitivity of 0.01, 0.1, 1.0 and 10 volts per division. A three-position toggle switch multiplies the slide switch selection by a factor of 1, 2 or 5. Additionally, a vernier knob allows the sensitivity to be continuously varied between settings of the switches if desired. When the vernier knob is placed in the CAL position, the sensitivity is specified to be within three percent of the switch settings.

If you are making critical voltage measurements, it is generally necessary to re-zero the scope trace each time the sensitivity setting on a channel is changed. This is readily accomplished by placing the channel's mode select switch into its center GND position and then tweaking the vertical position knob to set the trace at the desired zero-reference level on the display graticule.

The horizontal sweep rate can be selected to be anywhere from 0.5 second per division to 0.1 microsecond per division. Again, a vernier knob allows calibrated operation or any speed between the switch settings in an uncalibrated fashion.

The horizontal sweep can be initiated by an external signal, by a signal being displayed, at a rate synchronous with the 60 cycle line frequency if the unit is being run from an ac line source, or the sweep can be placed in a free-running mode. The free-running mode gives a continuous display regardless of what a signal is doing, and is thus useful for viewing the voltage levels of essentially steady-state signals. This is a feature that is convenient to have when tracing logic levels through a series of static gates.



A top view of the MS215 circuit board. CRT tube and batteries have been removed for this photo. Arrow points to rear mounting bracket for the CRT tube. Loosening a single screw on this bracket allows the CRT tube to be rotated slightly to correct a tilted display if necessary.

Mode of Operation

The scope can display a signal on channel one by itself, on channel two by itself, or it can display two signals simultaneously in either the so-called "chop" or "alternate" modes.

In the alternate mode, the scope shows one sweep of the signal on channel one, the next sweep on channel two and so forth. That is, it continuously alternates between displaying the two signals. The rate at which it alternates essentially depends on the horizontal sweep rate that has been selected by the operator. Of course, when the sweep rate is rapid enough, the two channels appear to be constantly displayed due to the latent image mechanism of the human eye.

In the chop mode, the oscilloscope also alternately displays the signals, only now the alternating is done at a fixed rate regardless of the settings of the horizontal sweep switches. This mode is fine for viewing signals that are relatively low in frequency, i.e., signals that are below approximately 20,000 cycles per second. Above that rate you are likely to observe gaps in the signals being displayed as the scope alternates between the two signals. (Of

course, that doesn't present any problem. It means you just switch over to the alternate mode of operation because signals requiring that rate of speed on the horizontal sweep will be fast enough to give a solid appearance in the alternate mode!)

You can adjust the triggering point of a signal being displayed so that the sweep starts on a negative or positive portion. You can even select the signal level at which triggering is to occur. I found the internal triggering capability of the scope to be quite good as long as the signal varied over about two vertical divisions or more. The manual says that at least one division of deflection is required to get reliable internal triggering. My scope will indeed trigger on signals at that level, but it is difficult to select a particular point on a signal when the deflection is that low. At two or more vertical divisions I find I can get good triggering control at points that I desire on most waveforms.

Other Features

You also have the option of using the XY mode. In this mode the horizontal sweep is controlled by an external signal of your choosing, instead of an



The NLS model MS215 weighs three pounds and is easily carried in one hand. (Photos courtesy of Non-Linear Systems, Inc., Del Mar CA 92014)

internal time base. This feature is necessary to satisfy all those people who want to look at Lissajous patterns or do TV vector analysis and so forth.

Would you believe this little scope even has a built-in one volt peak-to-peak square wave calibrating signal? This feature is convenient, especially when a signal you are tracing suddenly disappears and you want to quickly make sure that the

scope itself hasn't gone on the blink! (Isn't it amazing how we always question the performance of the test equipment we are using even though we know that the piece of gear we are using it on is not working in the correct fashion?)

This small, compact scope is also able to operate from its own internal batteries. It is simply fantastic! I can't count the number of times, prior to ob-

taining this scope, that I have wanted to check something out in an electronic gadget, only to be stopped by the inconvenience of not having a portable scope. Who wants to lug a 30 pound oscilloscope out to the garage, connect two or three extension cords in series and then try to work on a car radio in the front seat while trying to peer into the back seat to observe a scope trace?

Have you ever been working on a piece of digital circuitry on your bench and come to the conclusion that your logic probe alone wasn't going to solve the problem? Then, have you noted that every ac receptacle on your bench was in use (out of necessity, of course) and yet your oscilloscope was not plugged in? In order to be able to plug in your scope, you have to unplug your soldering iron. And then, as soon as you have done that, just after the soldering iron has cooled down, you find that you have to solder or unsolder a connection in order to make further

tests! Frustrating, isn't it?

You won't have those problems if you have an MS215! You can pick this little three pound beauty up in one hand, forget all the extension cords, run out to the garage and place it right on the front seat beside the radio you are working on—so you can probe circuits and view the results without straining your neck! You have three hours of scope operating time available when in the battery mode of operation. Since the scope is solid-state and has essentially "instant-on" capability, you can turn the scope off when not actually taking measurements. Thus, you can work practically all day in an isolated environment without needing any ac power.

All in all, I am favorably impressed by the NLS MS215 dual trace scope. I have not seen anything to match it in its price class (about \$430 at the time of this writing). The closest competition I have seen or heard of is well over twice its price. ■

MAGSAM™ KEYED FILE MANAGEMENT SYSTEM

Sophisticated applications made simple.

Put data at your fingertips... easily accessed, displayed, and updated by key. MAGSAM™ allows your CBASIC programs to create and access sophisticated keyed file structures through simple CBASIC statements.

Powerful, affordable, and easy to use.

MAGSAM™ is now available in three versions offering an array of features and capabilities. Standard MAGSAM™ features include random by key, sequential by key, generic by key, randomly by record number, and physical sequential access techniques. Each MAGSAM™ Package includes the MAGSAM™ file manager, tutorial program, file dump utility, User Guide, Reference Card, and one year update service.

- **MAGSAM™** — Most advanced version. Secondary Indexing with any number of keys, and Record and Key Deletion with automatic reuse of freed space. **\$145†**
- **MAGSAM II™** — Single Key support with full Record and Key Delete capability. **\$99†**
- **MAGSAM I™** — Entry level version. Single Key support without Delete functions. **\$75†**
- **MAGSAM™ User Guide only** — comprehensive tutorial and reference manual. **\$15**

Available for 8" soft sector, Micropolis, and TRS-80 disk formats. Requires CP/M™ or derivative and CBASIC. Distributed as CBASIC subroutines in source form.

Visa and MasterCard welcome. Dealer and OEM inquiries invited.



MICRO APPLICATIONS GROUP
7300 CALDUS AVENUE
VAN NUYS, CA 91406

➤ M103

* Trademark of Digital Research † Single site license



TRS-80 OWNERS!


We have a FREE program just for you. IDEA SEEDS™, a new concept in software from CECODAT. Each month you can receive a FREE program for your TRS-80, ready for use and/or customization, for just a self addressed-stamped envelope.

ACT AT ONCE...Send your self addressed-stamped envelope NOW--- before it slips your mind! It could be the best thing you have done for your TRS-80 Library.

FREE IDEA SEEDS™! ONLY FROM CECODAT!

➤ C128

CECODAT, Inc. P.O. Box 8963, Moscow, Idaho 83843



Is it Dungeons and Dragons or Dragons and Dungeons?*

Did you read about the fellow who became so enchanted playing D & D, he disappeared for a month?

Chances are, when you play the **Dunjonquest™** version, the greatest of all the role-playing fantasies, you'll be able to hold on to reality just a little better.

You're the hero. Enter into the Dunjonquest "Temple of Apshai" and into the greatest fantasy adventure you've ever experienced. The Temple has over 200 rooms and catacombs in which lurk more than 30 kinds of monsters and beasts ready to do you in—in real time—before you can reach any of the 70 or so treasures waiting for the hero. You may spend days, weeks, months... the rest of your life... striking at the forces of evil, or running from them, or calling on powers you can never completely understand. Always, always demonstrating in varying degrees your strength, constitution, dexterity, intelligence, intuition, the force of your ego.

Unlike chess or bridge or monopoly, this role-playing game—like other good role-playing games—is an **experience** rather than a game: It is not played so much as it's lived or experienced. Your alter ego goes

forth into the world of demons and darkness, dragons and dwarves. Your character will do whatever you want him (or her or it) to do.

Dunjonquest's "The Temple of Apshai" is **guaranteed** to be the best version of Dungeons and Dragons/Dragons and Dungeons. It's a product of the two guys who are Automated Simulations: Jim Connelley and Jon Freeman. Jim is a Dungeon Master, running continuous D & D campaigns. He's been a data processing professional with Westinghouse, GTE Sylvania, Logisticon... an expert in computer-based math-modeling and in simulation of complex phenomena. Jon is a game player, designer and author. He's a frequent contributor to **Games** magazine; his book: "The Playboy Winner's Guide to Board Games" is a paperback best-seller.

"The Temple..." comes complete with a superbly illustrated 56-page rule book and cassette program, designed to operate with the Level II 16K TRS 80, the PET 32K or the Apple II 48K (Microsoft) computer. Only \$24.95 complete, **including** shipping and handling on orders placed within the next 30 days.

And, as we said, **guaranteed**: Guaranteed to be the best version; guaranteed that you'll be happy with it. Order now, use it for two weeks. If you don't enjoy completely this fantasy adventure experience that goes beyond all others, send it back to us. We'll refund your money in full; no questions asked.

Master Charge or Visa card holders: charge "The Temple of Apshai" to your credit card. Just call our toll free number: (800) 824-7888, operator 861 (In California, call operator 861 (800) 852-7777. In Hawaii and Alaska, operator 861 (800) 824-7919) and you can begin enjoying your D & D game in days. Or send your check for \$24.95* to



Automated Simulations

Dept. K1
P.O. Box 4232
Mountain View, Ca. 94040

**Usually called "Dungeons and Dragons." But among knowledgeable people and Dungeonmasters, it's called "Dunjonquest."*

*California residents, please add 5.5% tax.

Chinese Character Generation

Here's another way to employ the Sorcerer's user-defined graphics keys.

Timothy Huang
9529 NE Gertz Circle
Portland OR 97233

There are two major reasons why I chose the Sorcerer microcomputer rather than others. First, it has the interchangeable ROM language pack, which I can plug, unplug or exchange to another language in seconds. No other systems have yet been

able to come close to this advantage. For example, with the Apple or the Radio Shack TRS-80, once the language firmware is installed, you are stuck with it, like it or not. It is almost, but not quite, impossible to change them. However, we (the users of Sorcerer) should remind Exidy that if they cannot provide other languages sooner, there will be a lot of complaints.

Are you listening, Exidy?

The second reason I chose the Sorcerer was its user-defined graphics keys, which are not shown in other systems. If you are thinking of getting into graphics, and your system does not provide this feature, then you will have to spend more money to buy disks and programs (as with the Apple II).

Once, when I was in a down-

town Portland computer-camera store (I am a shutterbug, too), the salesman tried to sell me an Apple computer. He said that his store conducted a six month's market research before deciding to sell the Apple. He put a disk into the machine and showed me all the magic graphics on the screen. He almost believed that I was sold. But after he learned that I already had a 32K Sorcerer, his attitude changed 180 degrees. He scoffed, "You spent more than a thousand bucks for that?" He then offered to trade an Apple for my system.

I was surprised, not only at his bad sales approach, but also his ignorance. Despite the six month's study, he missed the great features of the Sorcerer. By the way, I am not criticizing the Apple, but rather that salesman and the store owner.

The Sorcerer as a Ping-Pong Diplomat

The instruction manuals that come with the Sorcerer tell you how to use the user-defined graphics. If you happen to be Japanese, you can put the entire

中文輸出示範

黃大一創作
民國六十八年六月十日

微電腦的功用很多，其中

Photo 1. Chinese characters on the Sorcerer.

Japanese alphabet into it, and then type (or print out) a letter to your loved ones. The Sorcerer also accommodates all other alphabetical languages.

But I am neither Japanese nor a Yankee; I am Chinese. "Oh, well," as you Yankees would say, "the Chinese don't use the alphabet. Besides, they read and write backwards." True, we do not use the alphabet, but instead we use two-dimensional (square) graphical characters. According to scientists, the human eye can accept a pictorial message easier than a linear one. Besides, a quarter of the world's population is doing it.

However, we all paid a higher price for this precious cultural gem: We spent considerable time just learning and practicing to write the characters. For each character, each stroke, sequence and even every dot should be placed exactly right. No mistakes are allowed; otherwise you may end up expressing just the opposite of what you meant. Because of its unique features, we also don't have portable typewriters for our language. Let me tell you about the typewriter used in Taiwan, my homeland.

Typing a letter requires using a box about 2 feet by 2 feet containing about 2000 types, each with an imprinted character. The operator has to move a drum to the desired character position and press at the bottom to trigger the pick-up-and-hit-the-paper

mechanism. Just think how heavy 2000 lead-antimony-tin alloy types are. Maybe this is why there are no portable typewriters for the Chinese language; they would sacrifice the beautiful calligraphy.

My parents always said my handwriting was so terrible that they could not read my letters. So I made up my mind to give my parents, and the Chinese people, a good solution: a portable Chinese typewriter!

Sorcerer helped me to bring that dream one step closer to my long-desired goal. After tinkering with the machine for a while, I discovered (if the people at Exidy have not already accomplished this) a way to define the graphics keys without using the monitor program. With the BASIC language, you can define the desired graphics and save them with your main program without first loading the graphics through the monitor and doing your program through the BASIC. Plus, you can change the graphics within your BASIC language. This really simplifies the process.

Changing the Graphics

1. You still have to use the section paper to draw your graphics symbols.

2. Add up the numbers by decimal, not hex. The rightmost column is 1. Each subsequent column to the left is doubled. The leftmost column is 128. See Fig. 1.



Fig. 1. 8 x 8 dot matrix and data for Ω.

```

100 READ A
200 FOR J = 1 TO 8
250 READ B
300 POKE (W + J), B
400 NEXT J
500 POKE A, N
600 DATA 3888, 0, 56, 68, 130, 130, 68, 40, 238
700 END

```

Program 1. BASIC program to define graphic symbol Ω.

3. See Program 1 to put Ω onto the screen: In line 300, W + J values should be equal to the memory addresses (eight bytes). If you want to put Ω into key 192 (!key), then let W = -513. For the 193 key ("key), let W = -505, etc. In line 500, A is the position that you want this graphic to be

placed on the screen; N is the key number. (Try key 192; you will see the omega sign.) If you do not use POKE you can use the PRINT statement(s) to print it out. If so, you should omit the first number (3888) in line 600. Also, scratch line 100.

4. Make sure all the numbers

```

150 FOR X = 1 TO 38 : PRINT : NEXT
160 N = 0
170 RESTORE
180 W = 1205 : O = 128 : P = 129 : Q = 130 : R = 131
200 IF N = 32 GOTO 160
250 GOTO 500
260 N = N + 1
270 W = W - 32 : O = O + 4 : P = P + 4 : Q = Q + 4 : R = R + 4
280 GOTO 200
500 READ A
510 FOR J = 1 TO 32
520 READ B
530 POKE (J - W), B
540 NEXT J
550 POKE-A, O: POKE(1-A), P: POKE(64-A), Q: POKE(65-A), R
560 GOTO 260
1880 DATA 3888, 0, 1, 1, 1, 1, 31, 17, 17, 0, 0, 0, 0, 248, 16, 16, 17, 17, 31
1882 DATA 1, 1, 1, 1, 0, 16, 16, 248, 0, 0, 0, 0, 0, 0, 0, 0
1100 DATA 3884, 2, 1, 0, 0, 127, 16, 16, 8, 0, 0, 128, 0, 252, 16, 16, 32, 0, 4, 2
1102 DATA 1, 2, 4, 24, 0, 32, 64, 128, 0, 128, 64, 48, 0
1120 DATA 3880, 0, 32, 32, 248, 34, 248, 169, 170, 32, 80, 136, 4, 250, 0, 196
1122 DATA 84, 251, 170, 170, 251, 34, 250, 32, 0, 212, 84, 84, 212, 68, 68, 76, 0
1140 DATA 3876, 0, 1, 1, 17, 17, 17, 31, 1, 0, 0, 16, 16, 16, 248, 0, 1, 33, 33, 33
1142 DATA 63, 0, 0, 0, 8, 8, 8, 248, 0, 0, 0, 0, 0, 0, 0, 0
1160 DATA 3872, 0, 0, 0, 7, 0, 0, 31, 0, 0, 0, 192, 0, 0, 248, 0, 1, 5, 9, 17, 33
1162 DATA 5, 7, 0, 0, 64, 32, 16, 8, 0, 0, 0, 0, 0, 0, 0, 0
1180 DATA 3868, 32, 121, 137, 0, 16, 255, 16, 255, 128, 248, 64, 64, 0, 0, 124, 68
1182 DATA 146, 255, 146, 255, 16, 255, 16, 0, 68, 68, 72, 80, 65, 65, 126, 0
1810 DATA 3614, 8, 8, 63, 8, 15, 0, 127, 0, 32, 32, 248, 32, 224, 0, 252, 0, 63, 33
1812 DATA 63, 33, 63, 4, 56, 0, 248, 0, 248, 0, 248, 64, 56, 0
1830 DATA 3610, 0, 1, 1, 1, 63, 1, 1, 0, 0, 0, 0, 248, 0, 0, 2, 4, 8, 16, 32, 64, 0
1832 DATA 0, 128, 64, 32, 16, 8, 4, 0, 0
1850 DATA 3606, 0, 0, 0, 0, 0, 0, 127, 0, 0, 0, 0, 0, 252, 0, 0, 0, 0, 0, 0, 0
1852 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
1870 DATA 3602, 1, 2, 4, 9, 23, 36, 71, 132, 0, 130, 66, 34, 202, 74, 202, 74, 7, 4, 4
1872 DATA 11, 10, 18, 35, 0, 202, 10, 2, 226, 34, 42, 228, 0
1880 DATA 3600, 0, 8, 16, 49, 82, 148, 16, 16, 64, 64, 128, 0, 254, 64, 64, 120, 16, 16
1882 DATA 16, 16, 16, 16, 16, 64, 64, 124, 64, 64, 64, 64, 0
2140 DATA 3484, 0, 0, 31, 16, 16, 31, 16, 31, 0, 0, 248, 8, 8, 248, 128, 252, 32, 32
2142 DATA 32, 34, 36, 40, 48, 0, 128, 128, 64, 32, 16, 16, 4, 0
2150 DATA 3482, 255, 128, 129, 191, 129, 9, 189, 165, 254, 2, 2, 250, 2, 2, 18, 18
2152 DATA 164, 189, 128, 188, 129, 128, 255, 0, 146, 162, 66, 170, 18, 2, 254, 0
2160 DATA 3480, 0, 0, 8, 7, 0, 0, 63, 0, 0, 0, 224, 0, 0, 248, 0, 2, 4, 8, 16, 32, 64
2162 DATA 0, 128, 64, 32, 16, 8, 4, 0, 0
2170 DATA 3478, 0, 1, 1, 1, 1, 1, 1, 63, 0, 0, 0, 0, 0, 248, 1, 1, 1, 1, 1, 1, 0
2172 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
2180 DATA 3476, 0, 0, 0, 3, 0, 0, 2, 2, 0, 0, 192, 64, 64, 64, 4, 8, 16, 32
2182 DATA 64, 0, 0, 0, 32, 16, 8, 4, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
2190 DATA 3474, 0, 16, 47, 65, 129, 31, 17, 17, 0, 0, 224, 0, 0, 248, 0, 0, 127, 1
2192 DATA 1, 1, 1, 1, 0, 248, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
2200 DATA 3472, 0, 8, 7, 0, 0, 63, 0, 0, 0, 224, 0, 0, 248, 0, 2, 4, 8, 16, 32, 64
2202 DATA 0, 128, 64, 32, 16, 8, 4, 0, 0
2210 DATA 3470, 7, 4, 4, 4, 7, 4, 4, 4, 224, 32, 32, 32, 224, 32, 32, 7, 4, 4, 4
2212 DATA 8, 16, 0, 224, 32, 32, 32, 32, 96, 0
2220 DATA 3468, 0, 1, 1, 1, 1, 1, 1, 63, 0, 0, 0, 0, 0, 248, 1, 1, 1, 1, 1, 1, 0
2222 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
2230 DATA 3466, 0, 0, 7, 8, 8, 8, 8, 11, 0, 0, 248, 16, 16, 16, 16, 208, 8, 8, 8, 7
2232 DATA 0, 0, 16, 16, 16, 16, 248, 0, 0, 0
2650 DATA 3254, 17, 37, 69, 151, 32, 64, 175, 32, 0, 70, 68, 208, 30, 34, 212, 8
2652 DATA 39, 36, 36, 36, 36, 40, 32, 0, 136, 148, 148, 162, 162, 128, 96, 0
2660 DATA 3252, 31, 1, 127, 65, 85, 85, 65, 0, 252, 4, 84, 84, 4, 0, 63, 33
2662 DATA 63, 33, 63, 1, 1, 0, 248, 8, 248, 2, 254, 0
2670 DATA 3250, 0, 57, 74, 73, 72, 120, 72, 72, 146, 36, 72, 36, 146, 0, 64, 128
2672 DATA 73, 123, 73, 73, 137, 137, 1, 0, 254, 2, 74, 82, 34, 90, 254, 0
2680 DATA 3248, 16, 16, 32, 64, 129, 124, 68, 68, 32, 32, 64, 128, 0, 254, 2, 2, 68
2682 DATA 76, 84, 108, 68, 68, 124, 0, 66, 34, 34, 18, 4, 108, 24, 0
2690 DATA 3246, 0, 0, 0, 0, 127, 8, 8, 16, 16, 16, 254, 18, 18, 18, 8, 8, 255
2692 DATA 0, 1, 0, 34, 34, 34, 162, 68, 84, 136, 0
2700 DATA 3244, 31, 17, 17, 17, 31, 17, 17, 17, 248, 16, 16, 16, 248, 16, 16, 16
2702 DATA 31, 17, 33, 33, 65, 0, 0, 248, 16, 16, 16, 16, 48, 0, 0
2710 DATA 3242, 17, 33, 69, 137, 17, 49, 81, 145, 254, 2, 2, 254, 2, 2, 254, 4, 17
2712 DATA 17, 17, 17, 17, 17, 0, 68, 36, 16, 36, 68, 138, 0, 0
2720 DATA 3240, 2, 5, 8, 20, 34, 65, 2, 4, 0, 0, 128, 64, 128, 0, 32, 80, 8, 49, 66
2722 DATA 0, 0, 7, 0, 136, 68, 40, 16, 32, 192, 0, 0
2730 DATA 3238, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 7, 15, 15, 7, 0, 16, 15, 0
2732 DATA 192, 160, 144, 16, 32, 64, 128, 0
2740 DATA 3236, 4, 4, 31, 4, 4, 7, 4, 4, 32, 32, 248, 32, 32, 224, 32, 32
2742 DATA 7, 4, 4, 127, 2, 4, 24, 0, 224, 32, 32, 254, 64, 32, 24, 0
2750 DATA 3234, 0, 1, 1, 1, 31, 17, 17, 0, 0, 0, 0, 248, 16, 16, 17, 17, 31
2752 DATA 1, 1, 1, 0, 16, 16, 248, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0

```

Program 2. Chinese character output demonstration.

Double your memory ... not the price!

COMPARE AT \$695...

\$525

Remex RFD 4000/8" Floppy Disc Drive Double the storage! Double sided... Double density!!

Offers quality and features found in drives costing much more! ■ Single or Double Density ■ Double-Sided Drive ■ Door Lock INCLUDED ■ Write-Protect INCLUDED ■ 180 Day Warranty ■ Compatible with Shugart 850/851 ■ Low Power Operation ensures LONGER LIFE!! ■ Model RFD 4001 offers Data and Sector Separator

AVAILABLE OPTIONS/ACCESSORIES

- ☐ Dual Drive Power Supply and Cabinet, \$119.95
- ☐ Single Drive Power Supply and Cabinet, \$139.95
- ☐ Interface Manual, \$2.95
- ☐ RFD 4000 Manual, \$5.95
- ☐ Drive Cabinet, \$29.95

SIRIUS SYSTEMS, P.O. Box 9748, Knoxville, TN 37920

Phone orders accepted 9 AM-7 PM (E.S.T.): 615/577-1072, please send the following

☐ RFD 4000, \$325 ☐ RFD 4001, \$539 ☐ Check ☐ Money Order ☐ C.O.D. ☐ MC ☐ VISA ☐ AE

NAME _____ CARD # _____
ADDRESS _____ EXPIRATION DATE _____
CITY _____ STATE _____ ZIP _____ CARDHOLDERS SIGNATURE _____
Add \$7.00 per Drive for Shipping/Handling Tennessee residents add 6% sales tax. Foreign orders add 10% (payment in U.S. currency only)

You don't have to buy it just for the low price.

You can buy it for the quality, too!

If you've been looking for a less expensive floppy disc drive, but not wanting to sacrifice quality - your search is over!

You get both in the Remex RFD1000B! For only \$395 look at what you get: ■ 8" Floppy Drive ■ Single or Double Density ■ Hard or Soft Sectoring ■ Media Protection Feature ■ Single Density Data Separator ■ 90 Day Factory Warranty

AVAILABLE OPTIONS/ACCESSORIES

- ☐ Door Lock, \$19.95
- ☐ Dual Drive Power Supply, \$91.95
- ☐ Interface Manual, \$2.95
- ☐ Write-Protect, \$19.95
- ☐ Single Drive Power Supply, \$69.95
- ☐ Interface Adapter, \$12.95
- ☐ Connectors, \$9.95
- ☐ Drive Cabinet, \$24.95

REMEX RFD1000B

\$395

VOLUME DISCOUNTS AVAILABLE

SIRIUS SYSTEMS, P.O. Box 9748, Knoxville, TN 37920

✓ S113

Phone Orders accepted 9AM-7PM (E.S.T.): 615/577-1072

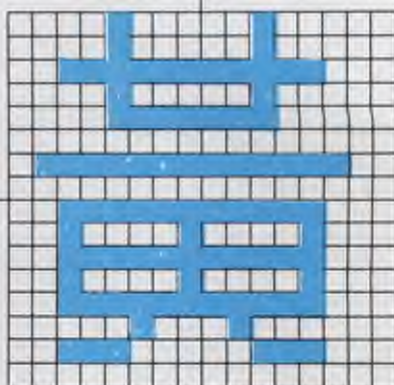
☐ Check ☐ Money Order ☐ C.O.D. ☐ MC ☐ VISA ☐ AE

NAME _____ CARD # _____
ADDRESS _____ EXPIRATION DATE _____
CITY _____ STATE _____ ZIP _____ CARDHOLDERS SIGNATURE _____
Add \$7.00 per Drive for Shipping/Handling Tennessee residents add 6% sales tax. Foreign orders add 10% (payment in U.S. currency only)

1	2
3	4

DECIMAL

8
8
63
8
15
0
127
0
63
33
63
33
63
4
56
0



DECIMAL

32
32
248
32
224
0
252
0
248
8
248
8
248
64
56
0

Fig. 2. Chinese character in a 16 x 16 dot matrix.

used in this program are decimal, not hex.

Chinese Character Generation and Output

First, enter the program, Chinese Character Output Demonstration (CSAVE name: CHI32). Make sure there are no mistakes when you enter the long data statements, such as using "." instead of "," between two numbers. Then type RUN (and RETURN). See Photo 1 for comparison. It's obvious that cramming a Chinese character into an 8 x 8 dot matrix is not reasonable, so I used a 16 x 16 dot matrix for each Chinese character (Fig. 2). Each quarter of this 16 x 16 matrix is numbered 1,2,3 and 4, starting at the upper left-hand corner. Each quarter is further divided into an 8 x 8 dot matrix as the Sorcerer will do.

If you can understand Program 1 (for the omega sign), you should not have too much trouble understanding this one. I put line 150 into the program to clear the screen first, since I have not discovered the "screen clearing" statement for the Sorcerer yet. (Does anyone know?) Line 200 is used to limit the output numbers of the characters to less than 32 for this demonstration. I tried to put more characters on the screen,

but have not had any success yet. The problem is that 32 characters will use up 128 (16 x 8) user-definable graphics keys. I wonder if the people at Exidy know a way (in BASIC, please) to change the data for each key without wiping out the earlier graphics data. I tried several approaches, but if I try to change the data, then all the characters on the screen will also change to identical characters. I end up with a screen full of the same characters.

Conclusions

By the way, the translation of the characters in Photo 1 is:

Chinese Character Output Demonstration
By Timothy Huang
June 10 of the year 68 of the Republic of China.
The usages of Microcomputers are many, one of which...

Before I try another program that can handle more characters, I wonder if anyone has ever encountered the error message: ? MO ERROR IN XX-XX. After consulting the list of Appendix D: Error Messages of the Sorcerer of "A Short Tour of BASIC" from Exidy, I cannot find out what it means.

Well, if anyone who can use this program would like to share his or her discoveries about the special graphics powers of the Sorcerer, I would appreciate hearing from you. ■

At Intersystems, "dump" is an instruction. Not a way of life.

(Or, when you're ready for IEEE S-100, will your computer be ready for you?)



We're about to be gadflies again.

While everyone's been busy trying to convince you that large buses housed in strong metal boxes will guarantee versatility and ward off obsolescence, we've been busy with something better. Solving the *real* problem with the first line of computer products built from the ground up to conform to the new IEEE S-100 Bus Standard. Offering you extra versatility in 8-bit applications today. And a full 16 bits tomorrow.

We call our new line Series II™. And even if you don't need the full 24-bit address for up to 16 megabytes (!) of memory right now, they're something to think about. Because of all the perform-

ance, flexibility and economy they offer. Whether you're looking at a new mainframe, expanding your present one or upgrading your system with an eye to the future. (Series II boards are compatible with most existing S-100 systems and all IEEE S-100 Standard cards as other manufacturers get around to building them.)

Consider some of the features: Reliable operation to 4MHz and beyond. Full compatibility with 8- and 16-bit CPUs, peripherals and other devices. Eight levels of prioritized interrupts. Up to 16 individually-addressable DMA devices, with IEEE Standard overlapped operation. User-selectable functions addressed by DIP-switch or jumpers, eliminating soldering. And that's just for openers.

The best part is that all this heady stuff is available now! In our advanced processor—a full IEEE Bus Master featuring Memory Map™ addressing to a full megabyte. Our fast, flexible 16K Static RAM and 64K Dynamic RAM boards. An incredibly versatile and

economical 2-serial, 4-parallel Multiple I/O board. 8-bit A/D-D/A converter. Our Double-Density High-Speed Disk Controller. And what is undoubtedly the most flexible front panel in the business. Everything you need for a complete IEEE S-100 system. Available separately, or all together in our new DPS-1 Mainframe!

Whatever your needs, why dump your money into obsolete products labelled "IEEE timing compatible" or other words people use to make up for a lack of product. See the future now, at your Intersystems dealer or call/write for our new catalog. We'll tell you all about Series II and the new IEEE S-100 Bus we helped pioneer. Because it doesn't make sense to buy yesterday's products when tomorrow's are already here.

InterSystems™

Ithaca Intersystems Inc.,
1650 Hanshaw Road/P.O. Box 91,
Ithaca, NY 14850
607-257-0190/TWX: 510 255 4346



Using Five-Level Teleprinters with a TRS-80

Why spend a kilobuck on a fancy printer when surplus 15s and 28s abound. Baudot lives on!

Brian Bateman
PO Box 399
Sharpes FL 32959

Unless you are one of the lucky ones, you don't have a lot of money to spend on a personal computer system. Yet, in spite of the groans from your bank account, and maybe your wife, you invested in the Radio Shack "bare essentials" TRS-80 Level II 16K machine. After all, who really needs those extra goodies such as a line printer, which can cost more than the computer itself?

Within a couple of months, you are operating your system with a fair degree of confidence. It is not until you have to debug one of your "biggie" programs or print a biorhythm chart that you start to appreciate the real worth of hard copy. Still, it might be difficult to justify upwards of \$1600 for a printer. But all is not lost, since I am going to show you how you can have hard copy for your machine at a very reasonable price.

The Radio Shack TRS-80 has the printer interface in its expansion interface. It also has

sockets for 32K more memory, an extra cassette interface, a real-time clock and a single chip disk controller. So just to get the printer interface you have to buy a box costing \$300, which is definitely a bit much for the guy who just wants hard copy. Even without this expense, the printers themselves are not inexpensive. Radio Shack sells one for close to

\$1300, which represents a single expense of more than the total you have so far invested in the system.

Teletype for Your TRS-80

Fortunately, some of the older Teletypes are becoming surplus items and are being sold at very reasonable prices. Probably the most abundant of these Teletypes are the five-

level Teletype Models 15 and 28.

The Model 15 was last manufactured in 1957, and about a quarter million were produced. It is a slow machine, typically 60 wpm. This speed, as with all five-level Teletypes, is the maximum speed, i.e., if no shifted characters are printed, since the Teletype must waste one character time in order to per-

FIGURES																LETTERS													
9	CR	5	blk	spc	#	.	7/8	.								0	CR	T	blk	spc	H	N	M						
9	CR	5	blk	spc	#	.	7/8	.								0	CR	T	blk	spc	H	N	M						
11000	01000	10000	00000	00100	10100	01100	11100									11000	01000	10000	00000	00100	10100	01100	11100						
P	\$	+	3	bet(')	6	/	/									R	D	Z	E	S	Y	F	X						
5/8	\$	+	3	bet(')	6	/	/									R	D	Z	E	S	Y	F	X						
11001	01001	10001	00001	00101	10101	01101	11101									11001	01001	10001	00001	00101	10101	01101	11101						
B	4	1	LF	8	0	:	3/8									G	R	L	LF	I	P	C	V						
B	4	3/4	LF	8	0	:	3/8									G	R	L	LF	I	P	C	V						
11010	01010	10010	00010	00110	10110	01110	11110									11010	01010	10010	00010	00110	10110	01110	11110						
fig	'(bet)	2	-	7	1	1/2	let									fig	J	W	A	U	Q	K	let						
fig	'(bet)	2	-	7	1	1/2	let									fig	J	W	A	U	Q	K	let						
11011	01011	10011	00011	00111	10111	01111	11111									11011	01011	10011	00011	00111	10111	01111	11111						
Communications (alternate char) Standard Bell System (TWX) Stock Market Weather Code Baudot 5-Bit Code																NOTE: "fig" - indicates a shift to "uppercase" "let" - indicates a shift to "lowercase" "blk" - is interpreted like a null "spc" - is the space "bet" - is the bell "CR" - is the carriage return "LF" - is the line feed													

Fig. 1. Diagram of the Model 28 type box (viewed from character side).

form the shift. Although slow, it gets the job done, producing a readable hard copy.

The Model 28 (Photo 1) is the most desirable of the five-level machines, since it is faster (typically 75 or 100 wpm), reasonably quiet and still being produced, making service and spare parts plentiful. The only difference between the 75 wpm and 100 wpm Model 28 is two gears, which can be obtained from Teletype service centers.

All of these Teletypes can be purchased for between \$50 and \$200, depending on your resourcefulness and the condition of the machine. This is a bargain, since the original price of these machines was from \$2000 to \$3500. The Models 15 and 28 are both heavy-duty machines capable of 24-hours-a-day operation.

The primary disadvantage of the five-level machines is that they do not have the full ASCII character set; in fact, they have only about 54 characters. With some careful manipulation, however, you can substitute these characters for some of the ASCII characters that it does not have; after a little practice you will be able to read a five-level listing almost as well as an ASCII listing.

Fig. 1 shows the five-level character set and how the bits are arranged for each character. Notice that each bit pattern has two key-codes assigned to it. This demonstrates that a particular code is interpreted

differently depending on whether or not the Teletype is currently in a shifted or unshifted condition. In order to change this condition, you must send either a "letters" (unshift) key-code or a "figures" (shift) key-code.

Now you can see why that quoted speed was a maximum speed. For example, if the Teletype is in an unshifted condition and typing letters, then no shift would need to be sent, but if you had to type a number, then you would have to first shift then type the number. The machine would then remain in the shifted condition until either the letters code or a space code was sent.

On most of the five-level Teletypes, every time a space is sent the Teletype automatically unshifts, no matter what its previous condition was. This is a waste of time when you have to type several numbers with spaces in between them. The Teletypes are set up to operate with or without this feature, but I suggest that you keep it in since this puts the machine in a periodic known unshifted condition. This allows the machine to synchronize itself with the computer without the need for extra wiring and hardware that would be necessary to allow the computer to check the status of the carriage or type box.

How Five-Level Works

Most of the five-level machines operate on a current loop, that is, a closed circuit be-



Photo 1. Teletype KSR Model 28.

tween the power supply and the selector magnet. Data is transmitted to the Teletype by breaking and closing this loop at carefully timed intervals. Just about all of these machines operate with a current of approximately 60 mA in the loop, although some of the Model 28s operate with a 20 mA loop.

Fig. 2 shows a typical timing sequence for the letters R and Y. Also included is a chart showing the length of these times for the different Teletype speeds. Notice that the start bit is a break in the current loop, and after one bit time, the first bit of the transmitted character arrives. After precisely five bit times (six total), the current loop is forced closed for one stop bit time. This allows the machine enough time to set up

for the next character. The times listed for the stop bit length are minimums.

Actually, the stop bit length is unimportant as long as it is greater than or equal to the minimum; however, to avoid slowing the Teletype down too much, this time should be kept as close to the minimum time as possible. The transmission of alternating Rs and Ys is a good worst-case test of the five-level machine, paralleling the transmission of the As and 5s in an ASCII machine.

When you first get your machine it will be wise to play with it a little bit before hooking it up to your computer. If your Teletype has a keyboard, which most of them have, then you should hook the keyboard in series with the printing

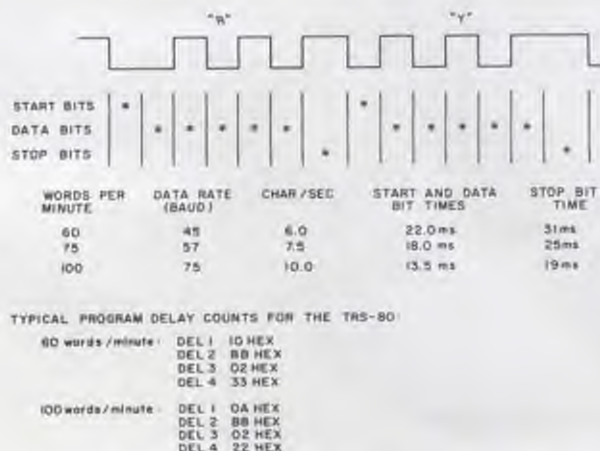


Fig. 2. Timing sequence for the letters R and Y.



Fig. 3. Simplified wiring diagram for the Model 28 five-level Teletype.



Photo 2. Screw terminal strip (visible behind paper roll with cover lifted).

mechanism in the current loop so you can type directly on the keyboard to the printing mechanism. In the event that you have a nonworking keyboard or no keyboard at all, then you should connect a switch wired with insulated alligator clips in series with the current loop.

Close the switch and turn on the Teletype, which should come on and be relatively quiet with only the hum of the motor. If, instead, it rattles like crazy, then the current loop is not closed. Even though the current is small in the loop, the voltage is 115 volts, so care should be taken when connecting and using the switch.

Fig. 3 shows the typical circuits for the Model 15 and 28 five-level Teletype. I have indicated some good points for completing the 60 mA current loop. The numbers preceded by C represent terminal connector numbers on the screw-type terminal strip (Photo 2) inside the Teletype. This number when suffixed with + indicates an RO or KSR Model 28, and when suffixed by * indicates an ASR

Model 28.

Keyboard contacts for all standard Model 28 Teletypes are terminals C9 and C10. So to put the keyboard in series with the typing unit requires only that the jumper between C20 and C21 be disconnected and then two jumpers (C9 to C20 and C10 to C21) be installed. Terminal C10 is not shown in Fig. 3 since it is in the keyboard signal generator loop.

Typically, the keyboard and typing unit are not connected together in their normal configuration as they would be installed by Teletype. However, even though C9 and C10 would appear to be in different places, they are actually adjacent terminal connections on the terminal strip.

To make this a working system, the Teletype interface should be connected to terminals C17 + (C128*), which is the "+" voltage, and C18 + (C127*), which is the "-" voltage. If your loop current is much lower than 60 mA and the Teletype does not print reliably, you can connect to terminal C22 + (C22*) instead of

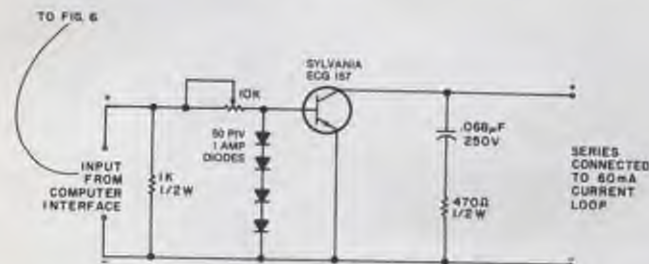
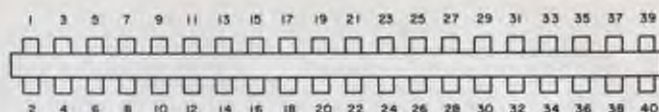


Fig. 4. Teletype interface.



Pin No.	Signal	Description
1	RAS*	Row address strobe output for 16 pin dynamic RAMs
2	SYSRES*	System reset
3	CAS*	Column address strobe output for 16 pin dynamic RAMs
4	A10	Address line
5	A12	Address line
6	A13	Address line
7	A15	Address line
8	GND	Signal ground
9	A11	Address line
10	A14	Address line
11	A8	Address line
12	OUT*	Address line
13	WR*	Address line
14	INTAK*	Interrupt acknowledge output
15	RD*	Memory read strobe output
16	MUX	Multiplexer control output for 16 pin dynamic RAMs
17	A9	Address line
18	D4	Data line
19	IN*	I/O input strobe
20	D7	Data line
21	INT*	Maskable interrupt
22	D1	Data line
23	TEST*	Tri-states the processor
24	D6	Data line
25	A0	Address line
26	D3	Data line
27	A1	Address line
28	D5	Data line
29	GND	Signal ground
30	D0	Data line
31	A4	Address line
32	D2	Data line
33	WAIT*	Processor wait for slow memory
34	A3	Address line
35	A5	Address line
36	A7	Address line
37	GND	Signal ground
38	A6	Address line
39	GND	Signal ground
40	A2	Address line

Fig. 5. Expansion port edge card (viewed from rear of TRS-80) and pin-out designations.

C18 + (C127*), which bypasses a resistor, thus increasing the loop current. There is a jumper between C9* and C127* as shown, so C9* can be used instead of C127* if it is more convenient.

The Model 15 is extremely simple with respect to its wiring. It has a two conductor wire, which is connected to the selector magnets on one end and a one-quarter inch phone plug on the other end. The keyboard is connected to another one-quarter inch phone plug the same way. If the Teletype does not come with a power supply, then you must build a 120 mA, 115 volt dc power supply with about a 6000 Ohm, 25 Watt resistor in line to control the loop current, which should be adjusted to 60 mA. The selector magnets, the keyboard, the Teletype interface

and the power supply should all be connected in series with each other to form the working system.

Once you have finally closed the loop, type on the keyboard if you have hooked it up, or open and close the switch rapidly and the Teletype should respond by typing some characters. At this point, it doesn't matter what it types, just so it types. If it passes this test, you can feel reasonably confident that the computer will be able to "talk" to it.

Basically, the computer has to "make and break" the circuit in precise patterns to instruct the Teletype as to what character to print. To do this we need some kind of switch. Since I don't like any more mechanical things in the system than I have to have, I chose a high voltage transistor. It

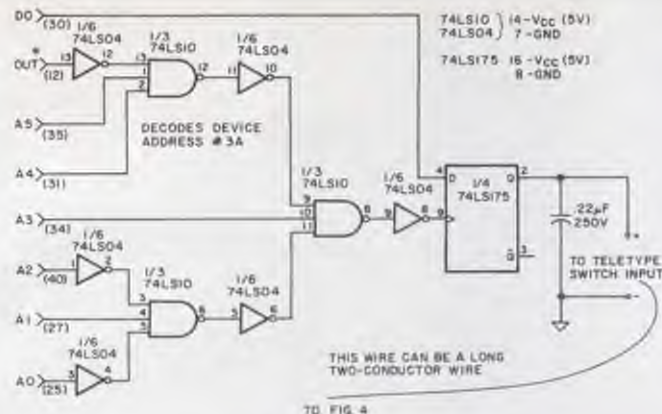


Fig. 6. Computer interface.

doesn't have to handle much current, but it should have a voltage rating of at least 150 volts. Fig. 4 shows this interface. It should be located relatively close to the Teletype. This interface actually does the switching of the 60 mA current loop.

Now, we need to have something to switch the transistor on and off.

The Computer Interface

On the back of the TRS-80 keyboard unit and the screen printer port on the expansion interface, there is a 40-pin bus with 20 tabs on each side of the printed circuit board. The pin-out designations are shown in Fig. 5.

The Z-80 microprocessor allows for 256 non-memory-mapped I/O devices to be connected to it. To "talk" to a device the Z-80 must place its "device address" (port address) on the lower eight address lines (A₀-A₇) and at the same time pulse the I/O sync line (OUT*).

Fig. 6 shows the schematic for the computer interface. If you follow the logic of the diagram you will see that it is configured for device address 3A (hex) or 58 (decimal). You can see that the diagram is extremely simple and only requires three chips. I used LS low-power Schottky chips for low power; however, regular TTL chips would work just as well. This circuit requires a minimal 5 volt power supply (see Fig. 7).

Once you have built this cir-

cuit, which should be located near the computer, just connect a pair of wires between the two interfaces. Also connect a 40-conductor ribbon cable with connector appropriately to the computer interface as shown. One note of caution here could save your having to rewire the ribbon cable! It seems that Radio Shack has labeled their 40-pin bus upside down. In other words, pin 1 is really pin 2 and pin 2 is really pin 1 on a standard connector and so on. Once you have triple-checked your wiring, you are ready to hook it all together.

One preliminary check you can make on the interface is to turn on the Teletype and type in the BASIC command "OUT 58,15." This should cause the Teletype to go quiet, except for the motor hum (i.e., close the loop). If it does not, then you have a problem somewhere. If this works OK, then issue the command "OUT 58,0." This should cause the Teletype to rattle. Again, issue the command "OUT 58,15." If the Teletype again goes quiet, then you have a working system.

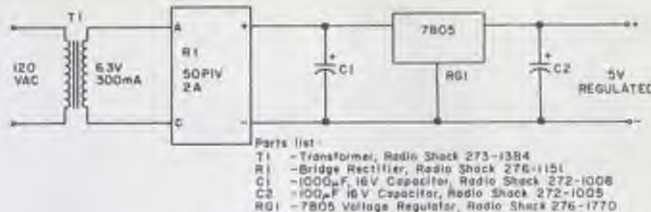


Fig. 7. 5 volt power supply circuit.

Software

Listing 1 shows the five-level driver routine. In some places it is seemingly clumsy, but I wanted to make the code positionally independent. In other words, without the use of an assembler, you can move this code around in memory, change two bytes (7F66 and 7F67) to the beginning address of the lookup table, and it will run. This was an extremely useful feature in the early days when I didn't have an assembler and even after I did finally get one. The entire driver subroutine is composed of less than 256 bytes of code.

The first 5F (hex) bytes of code are the ASCII-to-five-level lookup table. The relative location in the lookup table, with zero as the beginning, represents the ASCII character that it is equivalent to. For example, relative location 41 (hex) has the five-level equivalent for the letter A stored there. There are different types of information about the letter stored at that location, and each of the eight bits has its specific meaning (see Fig. 8).

Now that the lookup table has been established, we have to break this information down and send it to the Teletype. Relative byte 60 (hex) is the location I reserved to store the condition of the carriage, that

is, shifted or unshifted. This brings us to the entry point of the code, relative byte 61 (hex), which is labeled ENTRY. The code basically stores the ASCII character within the index instruction located at the label CHAR and then checks to see if the character is a legal character (i.e., less than or equal to 5F (hex)). This check is done by adding A0 (hex) to the ASCII character and checking for overflow. At label CHAR, the five-level equivalent for the ASCII character to be printed is loaded into the accumulator. The labels SPCK, LFCK and CRCK check for special cases (i.e., space, line feed and carriage return), since a carriage condition check is not necessary for these characters. In fact, the space, as I mentioned before, also unshifts the carriage regardless of its previous state.

The label PRTPCHR checks bit 7 of the five-level character to see if the character requires that the carriage be in the shifted or unshifted condition prior to printing the character. It then dispatches it appropriately to be set up for output to the Teletype.

In the location SHIFT, the shift status is stored in bit 0, and bit 7 being set signifies that two characters need to be output before returning to the

Listing 1. Five-level TTY Driver routine.

```

0000 ; ***** LISTING 1 *****
0010 ;
0020 ; ***** BASIC TTY DRIVER *****
0030 ; IT EXPECTS CHARACTER TO BE IN REGISTER "A"
0040 ;
0050 PORT EQU 3AH
0060 DEL 1 EQU 0AH
0070 DEL 2 EQU 08H
0080 DEL 3 EQU 2
0090 DEL 4 EQU 22H
0100 ;
0110 ORG 7F00H
0120 ORIGIN DEFB 00H
0130 DEFB 00H

```


7F02 40	01140	DEFB	40H
7F03 40	01150	DEFB	40H
7F04 40	01160	DEFB	40H
7F05 40	01170	DEFB	40H
7F06 40	01180	DEFB	40H
7F07 CA	01190	DEFB	0CAH
7F08 40	01200	DEFB	40H
7F09 40	01210	DEFB	40H
7F0A 40	01220	DEFB	40H
7F0B 40	01230	DEFB	40H
7F0C 40	01240	DEFB	40H
7F0D 50	01250	DEFB	50H
7F0E 40	01260	DEFB	40H
7F0F 40	01270	DEFB	40H
7F10 40	01280	DEFB	40H
7F11 40	01290	DEFB	40H
7F12 40	01300	DEFB	40H
7F13 40	01310	DEFB	40H
7F14 40	01320	DEFB	40H
7F15 40	01330	DEFB	40H
7F16 40	01340	DEFB	40H
7F17 40	01350	DEFB	40H
7F18 40	01360	DEFB	40H
7F19 40	01370	DEFB	40H
7F1A 40	01380	DEFB	40H
7F1B 40	01390	DEFB	40H
7F1C 40	01400	DEFB	40H
7F1D 40	01410	DEFB	40H
7F1E 40	01420	DEFB	40H
7F1F 40	01430	DEFB	40H
7F20 40	01440	DEFB	40H
7F21 0A	01450	DEFB	00AH
7F22 E2	01460	DEFB	0E2H
7F23 E2	01470	DEFB	0E2H
7F24 D2	01480	DEFB	0D2H
7F25 40	01490	DEFB	40H
7F26 F4	01500	DEFB	0FAH
7F27 D6	01510	DEFB	0D6H
7F28 DE	01520	DEFB	0DEH
7F29 E4	01530	DEFB	0E4H
7F2A D6	01540	DEFB	0D6H
7F2B F4	01550	DEFB	0FAH
7F2C D8	01560	DEFB	0D8H
7F2D C6	01570	DEFB	0C6H
7F2E FB	01580	DEFB	0FBH
7F2F FA	01590	DEFB	0FAH
7F30 EC	01600	DEFB	0ECH
7F31 EE	01610	DEFB	0EEH
7F32 E6	01620	DEFB	0E6H
7F33 C2	01630	DEFB	0C2H
7F34 D4	01640	DEFB	0D4H
7F35 E0	01650	DEFB	0E0H
7F36 EA	01660	DEFB	0EAH
7F37 CE	01670	DEFB	0CEH
7F38 CC	01680	DEFB	0CCH
7F39 F0	01690	DEFB	0F0H
7F3A DC	01700	DEFB	0DCH
7F3B FC	01710	DEFB	0FCH
7F3C DE	01720	DEFB	0DEH
7F3D DC	01730	DEFB	0DCH
7F3E E4	01740	DEFB	0E4H
7F3F F2	01750	DEFB	0F2H
7F40 40	01760	DEFB	40H
7F41 46	01770	DEFB	46H
7F42 72	01780	DEFB	72H
7F43 5C	01790	DEFB	5CH
7F44 52	01800	DEFB	52H
7F45 42	01810	DEFB	42H
7F46 5A	01820	DEFB	5AH
7F47 74	01830	DEFB	74H
7F48 68	01840	DEFB	68H
7F49 4C	01850	DEFB	4CH
7F4A 56	01860	DEFB	56H
7F4B 5E	01870	DEFB	5EH
7F4C 64	01880	DEFB	64H
7F4D 78	01890	DEFB	78H
7F4E 58	01900	DEFB	58H
7F4F 70	01910	DEFB	70H
7F50 6C	01920	DEFB	6CH
7F51 6E	01930	DEFB	6EH
7F52 54	01940	DEFB	54H
7F53 4A	01950	DEFB	4AH
7F54 60	01960	DEFB	60H
7F55 4E	01970	DEFB	4EH
7F56 7C	01980	DEFB	7CH
7F57 66	01990	DEFB	66H
7F58 7A	02000	DEFB	7AH
7F59 6A	02010	DEFB	6AH
7F5A 62	02020	DEFB	62H
7F5B 0A	02030	DEFB	00AH
7F5C 48	02040	DEFB	48H
7F5D 48	02050	DEFB	48H
7F5E 48	02060	DEFB	48H
7F5F 48	02070	DEFB	48H
7F60 00	02080	SHIFT	
7F61 DDE5	02090	ENTRY	
7F62 F5	02100	PUSH	
7F63 DD21007F	02110	LD	IX,ORIGIN
7F64 DD7778	02120	LD	(IX+CHAR+2-ORIGIN),A
7F65 C6A0	02130	ADD	A,0A0H
7F66 3004	02140	JR	NC,START
7F67 F1	02150	POP	AF
7F68 DDE1	02160	POP	IX
7F69 C9	02170	RET	
7F70 C5	02180	START	PUSH BC

7F74 D5	02190	PUSH	DE
7F75 E5	02200	PUSH	HL
7F76 DD7E00	02210	CHAR	A,(IX+0)
7F77 11FEF6	02220		DE,0F6FEH
7F78 0E3A	02230		C,PORT
7F79 FE40	02240	SPCK	CP
7F80 2006	02250		JR NZ,LFCR
7F82 DD CB 6006	02260	RES	0,(IX+SHIFT-ORIGIN)
7F86 182A	02270	JR	OUT CHR
7F88 FE44	02280	LFCR	CP
7F8A 2826	02290		JR Z,OUT CHR
7F8C FE50	02300	CRCK	CP
7F8E 2007	02310		JR NZ,PRTCHR
7F90 3E44	02320		LD A,44H
7F92 F5	02330		PUSH AF
7F93 3E50	02340		LD A,50H
7F95 1810	02350		JR DOUCHR
7F97 CB7F	02360	PRTCHR	BIT T,A
7F99 2054	02370		JR NZ,SBIT
7F9B DD CB 6046	02380		BIT 0,(IX+SHIFT-ORIGIN)
7F9F 2811	02390		JR Z,OUT CHR
7FA1 DD CB 6006	02400	UNSHF	RES 0,(IX+SHIFT-ORIGIN)
7FA5 F5	02410		PUSH AF
7FA6 78	02420		LD A,E
7FA7 DD CB 60FE	02430	DOUCHR	SET 7,(IX+SHIFT-ORIGIN)
7FAB 1805	02440		JR OUT CHR
7FAD DD CB 600E	02450	NEXT	RES 7,(IX+SHIFT-ORIGIN)
7FB1 F1	02460		POP AF
7FB2 2E07	02470	OUT CHR	LD L,7
7FB4 0F	02480	LOOP	RRCA
7FB5 3010	02490		JR NC,SPACE
7FB7 26FF	02500	MARK	LD H,0FFH
7FB9 ED61	02510		OUT (C),H
7FBB 060A	02520		LD B,DEL 1
7FBD C5	02530	TIM 1	PUSH BC
7FBE 0608	02540		LD B,DEL 2
7FC0 10FE	02550	DL 1	DJNZ DL 1
7FC2 C1	02560		POP BC
7FC3 10F8	02570		DJNZ TIM 1
7FC5 180E	02580		JR ENBIT
7FC7 2600	02590	SPACE	LD H,0
7FC9 ED61	02600		OUT (C),H
7FCB 060A	02610		LD B,DEL 1
7FCD C5	02620	TIM 2	PUSH BC
7FCE 0608	02630		LD B,DEL 2
7FD0 10FE	02640	DL 2	DJNZ DL 2
7FD2 C1	02650		POP BC
7FD3 10F8	02660		DJNZ TIM 2
7FD5 20	02670	END IT	DEC L
7FD6 200C	02680		JR NZ,LOOP
7FD8 0602	02690		LD B,DEL 3
7FDA C5	02700	TIM 3	PUSH BC
7FDB 0622	02710		LD B,DEL 4
7FDD 10FE	02720	DL 3	DJNZ DL 3
7FDF C1	02730		POP BC
7FE0 10F8	02740		DJNZ TIM 3
7FE2 DD CB 607E	02750	NCHAR	BIT 7,(IX+SHIFT-ORIGIN)
7FE6 20C5	02760		JR NZ,NEXT
7FE8 E1	02770		POP HL
7FE9 D1	02780		POP DE
7FEA C1	02790		POP BC
7FEB F1	02800		POP AF
7FEC DDE1	02810		POP IX
7FEE C5	02820		RET
7FEF DD CB 6046	02830	SBIT	BIT 0,(IX+SHIFT-ORIGIN)
7FF3 2000	02840		JR NZ,OUT CHR
7FF5 DD CB 60C6	02850	SET	SET 0,(IX+SHIFT-ORIGIN)
7FF9 F5	02860		PUSH AF
7FFA 7A	02870		LD A,D
7FFB 18AA	02880		JR DOUCHR
7F61	02890		END ENTRY

00000 TOTAL ERRORS

SET	7FF5
NCHAR	7FE2
DL 3	7FDD
TIM 3	7F0A
UL 2	7F00
TIM 2	7F00
END IT	7F00
DL 1	7F00
TIM 1	7F00
MARK	7F07
SPACE	7FC7
LOOP	7FB4
NEXT	7FAD
UNSHF	7FA1
SBIT	7FEF
DOUCHR	7FA7
PRTCHR	7F97
CRCK	7F8C
OUT CHR	7FB2
LFCR	7F88
SPCK	7F7E
START	7F73
CHAR	7F76
ENTRY	7F61
SHIFT	7F60
ORIGIN	7F00
DEL 4	0022
DEL 3	0002
DEL 2	0008
JEL 1	000A
PORT	003A

MACHINE LANGUAGE GAMES

AIR RAID, BARRICADE or RSL-1: - \$10.00 each, all 3 for \$25.00

Three popular machine language games now at new lower prices! All run on both Level-1 and Level-2 and require only 4K of memory. All may be converted for disk using DCV-1.

AIR RAID: Shoot down high speed aircraft with a steerable ground based missile launcher! Aircraft explode dramatically when hit, sometimes destroying other nearby planes! Score is tallied for each hit or miss, and the highest score is saved to be challenged by other players. Provides hours of fun for you, and a super program for entertaining friends!

BARRICADE: "BREAKOUT" for the TRS-80! Break through 5-wall Barricade with high-speed ball and keyboard controlled paddle! Trap the ball among the walls and watch it destroy the 100 blocks! Select 96 different options to challenge expert or beginner. 3 scores with the best of each saved to be challenged by other players.

RSL-1: Enter graphic patterns with repeating keyboard! Save patterns on tape (4 furnished). Play LIFE, a game of birth, growth and death of a colony of cells. FAST - about 1 second per generation! Hours of fascinating patterns!

ADVENTURE! \$14.95 each, (3 or more, \$12.50 each)

Level-II 16K machine language versions of Adventure, the current rage of the big time-share computers! 6 versions: 1-Adventureland, 2-Pirate's Adventure, 3-Mission Impossible, 4-Voodoo Castle, 5-The Count, and 6-Strange Odyssey. Each is a challenge that can take weeks to solve! Furnished on tape; convert to disk with DCV-1.

UTILITIES

RSM-2: AN ADVANCED TAPE MONITOR FOR 16K TRS-80'S - \$26.95
RSM-2D: THREE MONITORS FOR TRS-80 DISK SYSTEMS - \$29.95

22 commands to control your TRS-80 Z-80 processor! Examine ROM's, test RAM, program in machine language, read/write machine language tapes, and much more! SYMBOLIC DUMP will disassemble memory into Z-80 mnemonics! HEX and two ASCII memory dumps; EDIT, MOVE, EXCHANGE, VERIFY, FILL, ZERO, TEST, or SEARCH memory, read/write SYSTEM tapes, enter BREAKPOINTS, PRINT with TRS232 or Centronics, and read/write disk sectors directly! Radio Shack uses RSM; see page 4-17 of your disk manual! RSM-2 tape loads at top of 16K LEVEL I or II; RSM-2D disk includes 3 versions for 16K, 32K and 48K.

RSM-2 RELOCATOR: PUT RSM-2/2D ANYWHERE IN MEMORY - 9.95

This new program loads with the RSM-2/2D "L" tape command, then asks you where you want RSM-2 located. Your answer causes a new version to be created and executed! Instructions included for saving your new versions.

DCV-1: CONVERT SYSTEM PROGRAMS TO DISK FILES - \$9.95

EDTASH, The Electric Pencil, Air Raid, RSL-1, ESP-1, T-BUG, or nearly any SYSTEM tape can be executed from disk, even if it interferes with TRSDOS! DCV-1 loads system tapes into high memory and adds a block-move routine. TAPEDISK is then used to create a disk file. When accessed from disk, the program loads into high memory, moves itself to its correct address, then jumps there and executes! New version works with TRSDOS 2.2.

BASIC-1P: LEVEL-1 BASIC WITH PRINTING! - \$19.95

Loads into the top 4K of 16K TRS-80's and uses any LEVEL-1 BASIC program or DATA tape (up to 12K in length) without conversion! NEW commands, LPRINT and LLIST to print with either our TRS232 or the Radio Shack printer! Loads from tape or disk (furnished on tape). All LEVEL-1 abbreviations and functions supported!

CALIFORNIA Residents please add 6% state sales tax.

MODEL-II TRS-80

Small System Software is currently developing several programs for the Model II TRS-80. An enhanced RSM monitor with many new features will be available about January. We are adapting CP/M (tm Digital Research, Inc.) in conjunction with Lifeboat Associates. CP/M for the Model II will be a "standard" version and will run all existing CP/M software, including Cobol, Fortran, C-Basic, M-Basic, business and accounting packages, etc. Write for details!

PROFESSIONAL SOFTWARE

MICROSOFT SOFTWARE PACKAGES - \$80.00 each, \$150.00 for both

ASSEMBLER PACKAGE: Macro Assembler uses Zilog mnemonics and produces relocatable code! Includes Linking Loader, Editor and Cross Reference Utilities. Requires 32K and 1 disk drive.

FORTRAN PACKAGE: A true Fortran Compiler (faster than Basic). Linking Loader combines Fortran, Assembly and Library modules into one program! Editor and extensive Library are included. Requires 32K and at least 1 disk drive.

THE ELECTRIC PENCIL FOR TRS-80 DISK SYSTEMS - \$150.00
THE ELECTRIC PENCIL FOR TRS-80 TAPE SYSTEMS - 99.95

Write text, delete, insert, or move words, lines or paragraphs, save text on tape (or disk), then print formatted copy with our TRS232 or Centronics printer (RS-232-C with disk version). Right justification, page titling and numbering, transparent cursor and repeating keyboard. Upper case only, or lowercase with modification. Level-1 or 2 16K (tape version).

CP/M OPERATING SYSTEM WITH TRS232 SOFTWARE - \$145.00

SMALL SYSTEM SOFTWARE/LIFEBOT ASSOCIATES version of CP/M. Includes TRS232 and RS-232-C software, lower-case support, debounce, DCV-2 and other unique utilities. CP/M Editor creates and modifies all files. Assemble from disk, placing HEX and PRINT files back onto disk! Includes DDT (Dynamic Debugging Tool), PIP (Peripheral Interchange Program), and more! CP/M is a trademark of Digital Research, Inc.

PRINTER SUPPORT

TRS232 PRINTER INTERFACE - \$49.95 (+\$2.00 shipping)

Assembled and tested output port for TRS-80 printing. Use Diablo, Teletype, TI Silent or any RS-232 or 20-mil current loop ASCII printer. Expansion interface not required. Use with LEVEL-II BASIC, CP/M, BASIC-1P, ELECTRIC PENCIL, RSM-2/2D or your own programs! Standard cassette software included, or order new "FORMATTER" (below) for enhanced printer control.

TRS232 "FORMATTER" SOFTWARE PACKAGE - \$14.95

Enhanced software for with Level-2 Basic and our TRS232. Page and line length control, form feed function, printer pause, "smart" line termination, indented continuation lines, keyboard debounce, echo screen to printer, etc. Includes BASIC cassette and BASIC and machine language source listings.

PRINTER CONVERSION PACKAGES - \$9.95 EACH

Many programs do not include provisions for printing with either our TRS232 or the Radio Shack RS-232-C. We currently offer the following tapes for adding printing functions:

RSM RS-232-C: Adds RS-232-C capability to RSM-2/2D
PENCIL RS-232-C: For cassette version of Electric Pencil
EDTASH PRINT: TRS232 and RS-232-C for disk/tape EDTASH

OTHER TRS-80 PRODUCTS

ESP-1: \$29.95 Assembler, Editor & Monitor (8080 mnemonics)
LS1-1: 8.00 Listing of Level-1 BASIC with some comments

SMALL SYSTEM SOFTWARE



P. O. BOX 366



NEWBURY PARK, CA 91320

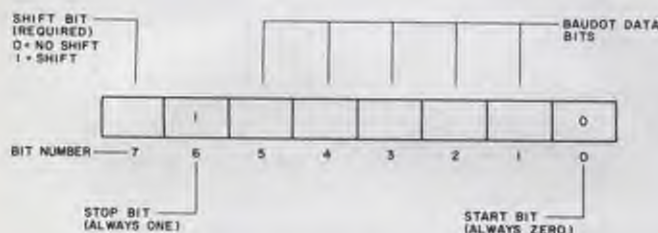

```

***** LISTING 2 *****
#1000 ;
#1010 ;
#1020 ; ***** BAUDOT HANDLER ROUTINE *****
#1030 ; THIS IS A HANDLER ROUTINE FOR THE BAUDOT TTY
#1040 ; AND IS TO BE USED IN CONJUNCTION WITH THE
#1050 ; BAUDOT DRIVER ROUTINE
#1060 ; IT WILL FUNCTION WITH THE TRS-80
#1070 ; LEVEL II BASIC
#1080 ; IF MEMORY IS CHANGED AS FOLLOWS:
#1090 ;      $26H(16422) TO $CAH(202)
#1100 ;      $27H(16423) TO $7EH(126)
#1110 ;
TE CA      #1110 ORG      TE CAH
7F 61      #1120 BAUDOT EQU      7F 61H
TE CA 79   #1130 BEGIN LD      A,C
TE CB 87   #1140 OR      A
TE CC FE 0B #1150 CP      0BH
TE CE 28 0A #1160 JR      Z,L 2
TED 0 FE 0C #1170 CP      0CH
TED 2 20 16 #1180 JR      NZ,L 3
TED 4 AF    #1190 XOR      A
TED 5 DDB 603 #1200 OR      (1X+03H)
TED 8 28 10 #1210 JR      Z,L 3
TED A DD 7E 03 #1220 L 2 LD      A,(1X+03H)
TED D DD 96 04 #1230 SUB      (1X+04H)
TEE 0 47     #1240 LD      B,A
TEE 1 3E 0A  #1250 L 4 LD      A,$AH
TEE 3 CD 61 7F #1260 CALL    BAUDOT
TEE 6 10 F9   #1270 DJNZ    L 4
TEE 8 18 11   #1280 JR      L 5
TEEA CD 61 7F #1290 L 3 CALL    BAUDOT
TEED FE 0D    #1300 CP      00H
TEEF C0       #1310 RET      NZ
TEF 0 DD 34 04 #1320 INC      (1X+04H)
TEF 3 DD 7E 04 #1330 LD      A,(1X+04H)
TEF 6 DD BE 03 #1340 CP      (1X+03H)
TEF 9 79      #1350 LD      A,C
TEFA C0       #1360 RET      NZ
TEFB DD J6 00 00 #1370 L 5 LD      (1X+04H),0
TEFF C9       #1380 RET
TECA          #1390 END      BEGIN
##### TOTAL ERRORS
L5      7EFB
L4      7EE 1
L3      7EEA
L2      7EDA
BEGIN   7ECA
BAUDOT  7F 61

```

powered up, it automatically initializes itself to communicate with the TRS-80 line printer through the expansion interface. Now we need to reinitialize the Level II pointers to our routine rather than its own. This pointer is located in the Lineprinter Control Block at decimal address locations 16422 and 16423. We cannot just put the entry address of the driver routine here, since there are certain things we have to handle other than just print out the character itself. The TRS-80 line-printer routine takes care of functions such as counting the number of lines printed, and if it receives the result of the command LPRINT CHR\$(12), it can even skip to the top of a new page. Since I was going to the trouble of writing the driver, it seemed only reasonable that I should also include these features.

calling program. This situation occurs when the carriage must be shifted or unshifted before the character can be printed, or whenever a carriage return is output, since a line feed must be issued with the carriage return. This is necessary since the TRS-80 does not output a line feed after printing a carriage return. It expects the printer to automatically execute a line feed whenever it sends out a carriage return.



a full 16-bit address and each word in memory is only eight bits. The order in which these locations are loaded is very important. The Z-80 expects to see the least significant eight bits of the address in the first location and the most significant eight bits in the second location. To find out what we need to put in these locations requires some relatively simple calculations.

Since the entry point to the handler routine shown in Listing 2 is address 7ECA (hex), the first thing to do is break it up into two parts (most significant and least significant). The most significant eight bits is 7E (hex) and the least significant eight bits is CA (hex). Now unless you are using disk BASIC, you won't be able to use this information directly; you will have to convert it to decimal. Converting any two-digit hex number to decimal requires that you multiply the left-most digit by 16 (assigning A = 10, B = 11, C = 12, D = 13, E = 14 and F = 15) and add it to the right-most digit.

Following this, you will see that 7E (hex) is equal to 126 (decimal) and CA (hex) is equal to 202 (decimal). At this point, changing the pointers consists of issuing two Level II BASIC commands: "POKE(16422), 202" and "POKE(16423), 126." Now the LPRINT and LLIST commands will write directly to your Teletype as if it were the TRS-80 line printer.

For those of you who also want your assembler to list its output to the Teletype, the solution is not quite as simple. Although, with the program shown in Listing 3, you should have no problems at all.

This code to modify the assembler is divided into three sections. The first section beginning at the label SETUP simply takes the other two sections and overlays them on top of the assembler in the proper places. The second section, beginning at the label START, should look familiar since it is a copy of the software interface between Level II BASIC and the driver routine. This routine is also needed with the assembler

to make it perform its printer functions properly.

The third section, consisting of the code associated with labels MEM1 and SETMEM, is mainly a nondestructive memory size routine. It will go through memory looking for the

last location of RAM. Once it finds that, it will subtract the amount of memory taken up by the print routine and then pass that result to the assembler at its memory size. This is necessary since the assembler goes all the way to the end of

memory to store its symbol table.

To make the patch to the assembler and then run it, reset the machine and answer the memory size query with a number that will protect your print routine when you load it. In a

```

#1000 ; ***** LISTING 3 *****
#1010 ;
#1020 ; THIS PROGRAM WILL MODIFY THE TRS-80 ASSEMBLER
#1030 ; SO THAT AN ALTERNATE PRINT ROUTINE
#1040 ; CAN BE USED. THE ENTRY POINT OF THE
#1050 ; PRINT ROUTINE SHOULD BE EQUATED TO "BAUDOT".
#1060 ; "SIZE" SHOULD BE EQUATED TO THE SIZE OF THE
#1070 ; PRINT ROUTINE IN BYTES PLUS 20 EXTRA BYTES.
#1080 ; THIS ASSUMES THAT THE PRINT ROUTINE IS LOCATED
#1090 ; AT THE END OF MEMORY.
#1100 ;
#1110 ; YOU MUST LOAD BUT NOT EXECUTE BOTH THE ASSEMBLER
#1120 ; AND THE PRINT ROUTINE BEFORE LOADING AND EXECUTING
#1130 ; THIS PROGRAM.
#1140 ;
#1150 ; PROGRAM NAME -- "ASMMOD"
#1160 ;
#1170 ORG 7E00H
#1180 BAUDOT EQU 0FF55H
#1190 SIZE EQU 1300H
#1200 SETUP LG HL, START
#1210 LD DE, 45AAH
#1220 LD BC, SETMEM-START
#1230 LDIR
#1240 LD HL, SETMEM
#1250 LD DE, 4695H
#1260 LD BC, 0AH
#1270 LDIR
#1280 JP 460AH
#1290 START LD A, C
#1300 OR A
#1310 CP 0BH
#1320 JR Z, L2
#1330 CP 0CH
#1340 JR NZ, L3
#1350 XOR A
#1360 OR (IX+03H)
#1370 JR Z, L3
#1380 L2 LD A, (IX+03H)
#1390 SUB (IX+04H)
#1400 LD B, A
#1410 LD A, 0AH
#1420 CALL BAUDOT
#1430 DJNZ L4
#1440 JR L5
#1450 L3 CALL BAUDOT
#1460 CP 00H
#1470 RET NZ
#1480 INC (IX+04H)
#1490 LD A, (IX+04H)
#1500 CP (IX+03H)
#1510 LD A, C
#1520 RET NZ
#1530 L5 LD (IX+04H), 0
#1540 RET
#1550 ;
#1560 MEM1 INC HL
#1570 LD A, (HL)
#1580 LD B, A
#1590 CPL
#1600 LD (HL), A
#1610 CP (HL)
#1620 LD (HL), B
#1630 JR Z, MEM1
#1640 XOR A
#1650 RET
#1660 SETMEM CALL 45AAH+MEM1-START
#1670 PUSH BC
#1680 LD BC, SIZE
#1690 SB C
#1700 POP BC
#1710 END SETUP
#1720
#1730 TOTAL ERRORS
#1740
MEM1 7E4F
L5 7E4A
L4 7E30
L3 7E39
L2 7E29
SETMEM 7E5A
START 7E19
SETUP 7E00
SIZE 0130
BAUDOT FF55

```

Listing 3. Assembler modification.

16K machine, 32000 is a good answer for this print routine. Now type "SYSTEM" (enter) and then load the print routine. The assembler should then be loaded but not executed. Finally, this routine for the patch should be loaded. Now just type "I" (enter). Within a few

moments, the assembler should clear the screen and print its usual sign-on message. The assembler is now ready to go and will dump all of its printer output to the Teletype.

In order to use the print routine with Level II BASIC, a

similar procedure is followed. You still protect memory with the same memory size answer as before and load the print routine into the machine under "SYSTEM." Then just press the "BREAK" key and "poke" the two locations 16422 and 16423 as was discussed earlier. Final-

ly, you have a completely operational system.

Five-Level Phase II

The only real complaint you could have is that the output would be a little more readable to other people if you had a few extra characters in the charac-

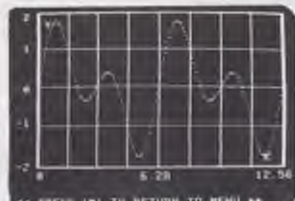
Listing 4. Special handler routine.

```

01000 : ***** LISTING *****
01010 :
01020 : ***** BAUDOT HANDLER ROUTINE *****
01030 : THIS IS A HANDLER ROUTINE FOR THE BAUDOT TTY
01040 : AND IS TO BE USED IN CONJUNCTION WITH THE
01050 : BAUDOT DRIVER ROUTINE
01060 : IT WILL FUNCTION WITH THE TRS-80
01070 : LEVEL II BASIC
01080 : IF MEMORY IS CHANGED AS FOLLOWS:
01090 : *26KH(16422) TO 0BEN(198)
01100 : *26KH(16423) TO 0FEN(254)
01110 :
01120 : THIS IS A SPECIAL ROUTINE TO UTILIZE THE BAUDOT
01130 : TYPE BOX TO ITS FULLEST POTENTIAL. IT WILL ALLOW
01140 : THE ADDITION OF UP TO 6 MORE CHARACTERS TO THE
01150 : TYPE BOX.
01160 :
01170 : ALSO THIS IS SPECIFICALLY WRITTEN FOR THE BAUDOT
01180 : MODEL 28 WITH THE 18WPM GEAR SET INSTALLED.
01190 : HOWEVER, THE SPEED CAN BE MODIFIED BY CHANGING
01200 : DEL1, DEL2, DEL3, AND DEL4.
01210 :
01220 : PROGRAM NAME -- "BAUDOT"
01230 :
01240 : ORG 0FEBH ; CHAR IN C-REG
01250 : BEGIN LD A,C
01260 : OR A
01270 : CP 0BH ; TOP OF FORM
01280 : JR Z,L2
01290 : CP 0EH
01300 : JR NZ,L3
01310 : XOR A
01320 : OR (1X+03H)
01330 : JR Z,L3
01340 : LD A,(1X+03H)
01350 : SUB (1X+04H)
01360 : LD 0,A
01370 : LD 0,A
01380 : CALL 0039H
01390 : DJNZ L4
01400 : JR L5
01410 : CALL 0039H
01420 : CP 0BH ; CHECK CR
01430 : RET NZ
01440 : INC LINE COUNT
01450 : LD A,(1X+04H)
01460 : CP (1X+03H) ; CHECK END OF PAGE
01470 : LD A,C
01480 : RET NZ
01490 : LD (1X+04H),0 ; ZERO LINE COUNT
01500 : RET
01510 :
01520 : ***** BAUDOT TTY DRIVER *****
01530 : IT EXPECTS CHARACTER TO BE IN REGISTER "A"
01540 :
01550 : EQU 0AH ; OUTPUT PORT
01560 : DEL1 EQU 0AH
01570 : DEL2 EQU 0BH
01580 : DEL3 EQU 2
01590 : DEL4 EQU 22H
01600 :
01610 : BEGINNING OF THE ASCII TO BAUDOT LOOKUP TABLE
01620 :
01630 : ORIGIN DEFB 0BH ; NUL
01640 : DEFB 0BH ; SOH
01650 : DEFB 0BH ; SI
01660 : DEFB 0BH ; ETX

```


NEW APPLE II® SOFTWARE



FUNCTION PLOT \$24.95



APPLE INVADERS GAME



I-CHING \$15.95



TRIVIA BOX \$19.95



CASSETTE \$15.95



SHAPE BUILDER \$19.95



MOTO-CROSS \$9.95



DISKETTE \$19.95



BLOCKADE \$9.95



FRUSTRATION \$9.95



GUIDED MISSILE \$15.95



LASER BLAST \$9.95



THE PLANETS \$15.95

AND MORE...

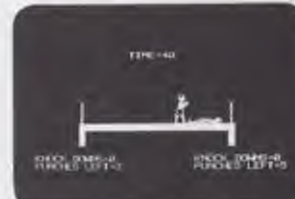
ACTIVE FILTERS	\$24.95
ALIEN INVASION	9.95
AMPERSORT II	15.95
APPLE ALLEY	6.95
BASEBALL	15.95
BATTLEFIELD	9.95
BREAKTHRU	9.95
CHECK BOOK	34.95
DATABASE MAILER	29.95
DEATH RACE	15.95
EARTH QUEST	19.95
HOME BUDGET	24.95
HOUSEHOLD FINANCE	24.95
MINI GENERAL LEDGER	59.95
MOUSE HOLE	6.95
PEG JUMP	9.95
RICOCLETTE	9.95
STAR VOYAGER	15.95
STUNT CYCLE	15.95

All orders must include 3% postage and handling. California residents add 6% sales tax. VISA and MASTERCARD accepted.

Apple II is a trademark of Apple Computers, Inc.

PROGRAMMA
INTERNATIONAL, Inc.
3400 Wilshire Blvd.
Los Angeles, CA 90010
(213) 384-0579
384-1116
384-1117 ✓P48

Dealer Inquiries Invited



BOXING \$9.95



ALGEBRA I \$15.95



SPACE WAR \$9.95



SIRIUS \$15.95

PROGRAMMA

Software Program Products

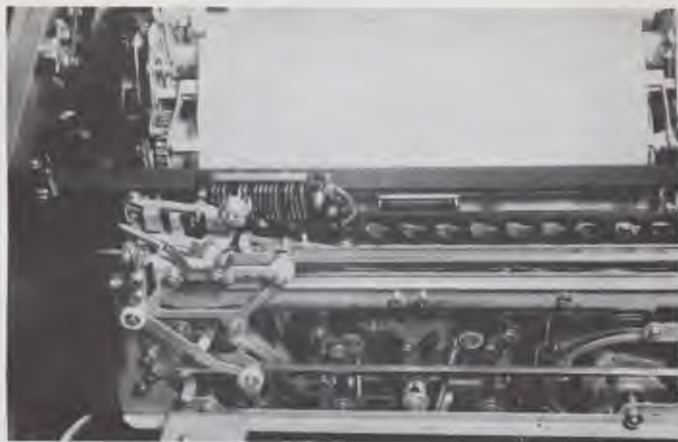


Photo 3. Installed type box with hammer over the + pallet.

ter set. Of the characters that Radio Shack uses, the five-level Teletype is missing the <, >, %, =, +, *, @, and ., which I will have to agree are some very useful symbols to have. I finally decided that they would be useful enough to warrant some study on just how I might go about making the five-level Teletype print these characters.

I am by no means implying that the five-level Teletype is not useful without these char-

acters, since I have been using one without them for a couple of years. In my opinion, the ability to have hard copy, even without these symbols, has been absolutely invaluable. However, I can still appreciate having them.

I began to study the type box (see Photos 3, 4 and 5) on the Model 28 and its printing mechanism. Although I said the five-level machine only has about 54 characters, that was only partially correct. If you



Photo 4. Type box with additional characters (pallets) installed.

figure out how many combinations there are with five data bits, you will come up with 32, which will double if you figure in the shift. So if there are 64 possible combinations, then why is there a difference of ten characters? Well, if you look at the type box in Fig. 1, you will see how the Model 28 type box keys are laid out. The figures and letters shift codes take up four characters—two in lowercase and two in uppercase. The blank takes up two characters, and the space, bell, line feed and carriage return take up one apiece for a total of ten "wasted" characters.

This seemed unnecessary,

so I decided to see if anything could be done about it. The clue was that none of these characters positions in the type box contained any type keys, but when the character code was actually decoded by the Teletype it still went through the motion of printing the character even though it was not there. What Teletype had done was to tie these decodes to what they call function levers, which operate certain mechanical functions not related to actually typing a character (e.g., line feed, carriage return, etc.). I decided to give up some of the functions I didn't need to be able to print some extra

FF43 78	DEFB	78H	1 0	AF	CHAR+2)A	1 STORE ASC CHAR
FF44 6C	DEFB	6CH	1 P	AF	A:WABH	1 LEGAL CHAR?
FF45 6E	DEFB	6EH	1 Q	AF	NC:START	
FF46 5A	DEFB	5AH	1 R	AF		
FF47 4A	DEFB	4AH	1 S	AF		
FF48 60	DEFB	60H	1 T	AF		
FF49 4E	DEFB	4EH	1 U	AF		
FF4A 7C	DEFB	7CH	1 V	AF		
FF4B 66	DEFB	66H	1 W	AF		
FF4C 7A	DEFB	7AH	1 X	AF		
FF4D 6A	DEFB	6AH	1 Y	AF		
FF4E 62	DEFB	62H	1 Z	AF		
FF4F 0A	DEFB	0AH	1 UP-ARROW	AF		
FF50 4B	DEFB	4BH	1 DOWN-ARROW	AF		
FF51 48	DEFB	48H	1 LEFT-ARROW	AF		
FF52 4B	DEFB	4BH	1 RIGHT-ARROW	AF		
FF53 4B	DEFB	4BH	1 UNDERLINE	AF		
FF54 4B	DEFB	4BH	1 CARRIAGE POS	AF		
FF55 F5	DEFB	F5H	1	AF		
FF56 32AFF	DEFB	32AFF	1	AF		
FF57 6A8	DEFB	6A8	1	AF		
FF58 38B2	DEFB	38B2	1	AF		
FF59 F1	DEFB	F1H	1	AF		
FF5A C9	DEFB	C9H	1	AF		
FF5B C5	DEFB	C5H	1	AF		
FF5C 05	DEFB	05H	1	AF		
FF5D 05	DEFB	05H	1	AF		
FF5E 05	DEFB	05H	1	AF		
FF5F 05	DEFB	05H	1	AF		
FF60 05	DEFB	05H	1	AF		
FF61 05	DEFB	05H	1	AF		
FF62 05	DEFB	05H	1	AF		
FF63 05	DEFB	05H	1	AF		
FF64 05	DEFB	05H	1	AF		
FF65 05	DEFB	05H	1	AF		
FF66 05	DEFB	05H	1	AF		
FF67 05	DEFB	05H	1	AF		
FF68 05	DEFB	05H	1	AF		
FF69 05	DEFB	05H	1	AF		
FF6A 05	DEFB	05H	1	AF		
FF6B 05	DEFB	05H	1	AF		
FF6C 05	DEFB	05H	1	AF		
FF6D 05	DEFB	05H	1	AF		
FF6E 05	DEFB	05H	1	AF		
FF6F 05	DEFB	05H	1	AF		
FF70 05	DEFB	05H	1	AF		
FF71 05	DEFB	05H	1	AF		
FF72 05	DEFB	05H	1	AF		
FF73 05	DEFB	05H	1	AF		
FF74 05	DEFB	05H	1	AF		
FF75 05	DEFB	05H	1	AF		
FF76 05	DEFB	05H	1	AF		
FF77 05	DEFB	05H	1	AF		
FF78 05	DEFB	05H	1	AF		
FF79 05	DEFB	05H	1	AF		
FF7A 05	DEFB	05H	1	AF		
FF7B 05	DEFB	05H	1	AF		
FF7C 05	DEFB	05H	1	AF		
FF7D 05	DEFB	05H	1	AF		
FF7E 05	DEFB	05H	1	AF		
FF7F 05	DEFB	05H	1	AF		
FF80 05	DEFB	05H	1	AF		
FF81 05	DEFB	05H	1	AF		
FF82 05	DEFB	05H	1	AF		
FF83 05	DEFB	05H	1	AF		
FF84 05	DEFB	05H	1	AF		
FF85 05	DEFB	05H	1	AF		
FF86 05	DEFB	05H	1	AF		
FF87 05	DEFB	05H	1	AF		
FF88 05	DEFB	05H	1	AF		
FF89 05	DEFB	05H	1	AF		
FF8A 05	DEFB	05H	1	AF		
FF8B 05	DEFB	05H	1	AF		
FF8C 05	DEFB	05H	1	AF		
FF8D 05	DEFB	05H	1	AF		
FF8E 05	DEFB	05H	1	AF		
FF8F 05	DEFB	05H	1	AF		
FF90 05	DEFB	05H	1	AF		
FF91 05	DEFB	05H	1	AF		
FF92 05	DEFB	05H	1	AF		
FF93 05	DEFB	05H	1	AF		
FF94 05	DEFB	05H	1	AF		
FF95 05	DEFB	05H	1	AF		
FF96 05	DEFB	05H	1	AF		
FF97 05	DEFB	05H	1	AF		
FF98 05	DEFB	05H	1	AF		
FF99 05	DEFB	05H	1	AF		
FF9A 05	DEFB	05H	1	AF		
FF9B 05	DEFB	05H	1	AF		
FF9C 05	DEFB	05H	1	AF		
FF9D 05	DEFB	05H	1	AF		
FF9E 05	DEFB	05H	1	AF		
FF9F 05	DEFB	05H	1	AF		
FFA0 05	DEFB	05H	1	AF		
FFA1 05	DEFB	05H	1	AF		
FFA2 05	DEFB	05H	1	AF		
FFA3 05	DEFB	05H	1	AF		
FFA4 05	DEFB	05H	1	AF		
FFA5 05	DEFB	05H	1	AF		
FFA6 05	DEFB	05H	1	AF		
FFA7 05	DEFB	05H	1	AF		
FFA8 05	DEFB	05H	1	AF		
FFA9 05	DEFB	05H	1	AF		
FFAA 05	DEFB	05H	1	AF		
FFAB 05	DEFB	05H	1	AF		
FFAC 05	DEFB	05H	1	AF		
FFAD 05	DEFB	05H	1	AF		
FFAE 05	DEFB	05H	1	AF		
FFAF 05	DEFB	05H	1	AF		
FFB0 05	DEFB	05H	1	AF		
FFB1 05	DEFB	05H	1	AF		
FFB2 05	DEFB	05H	1	AF		
FFB3 05	DEFB	05H	1	AF		
FFB4 05	DEFB	05H	1	AF		
FFB5 05	DEFB	05H	1	AF		
FFB6 05	DEFB	05H	1	AF		
FFB7 05	DEFB	05H	1	AF		
FFB8 05	DEFB	05H	1	AF		
FFB9 05	DEFB	05H	1	AF		
FFBA 05	DEFB	05H	1	AF		
FFBB 05	DEFB	05H	1	AF		
FFBC 05	DEFB	05H	1	AF		
FFBD 05	DEFB	05H	1	AF		
FFBE 05	DEFB	05H	1	AF		
FFBF 05	DEFB	05H	1	AF		
FFC0 05	DEFB	05H	1	AF		
FFC1 05	DEFB	05H	1	AF		
FFC2 05	DEFB	05H	1	AF		
FFC3 05	DEFB	05H	1	AF		
FFC4 05	DEFB	05H	1	AF		
FFC5 05	DEFB	05H	1	AF		
FFC6 05	DEFB	05H	1	AF		
FFC7 05	DEFB	05H	1	AF		
FFC8 05	DEFB	05H	1	AF		
FFC9 05	DEFB	05H	1	AF		
FFCA 05	DEFB	05H	1	AF		
FFCB 05	DEFB	05H	1	AF		
FFCC 05	DEFB	05H	1	AF		
FFCD 05	DEFB	05H	1	AF		
FFCE 05	DEFB	05H	1	AF		
FFCF 05	DEFB	05H	1	AF		
FFD0 05	DEFB	05H	1	AF		
FFD1 05	DEFB	05H	1	AF		
FFD2 05	DEFB	05H	1	AF		
FFD3 05	DEFB	05H	1	AF		
FFD4 05	DEFB	05H	1	AF		
FFD5 05	DEFB	05H	1	AF		
FFD6 05	DEFB	05H	1	AF		
FFD7 05	DEFB	05H	1	AF		
FFD8 05	DEFB	05H	1	AF		
FFD9 05	DEFB	05H	1	AF		
FFDA 05	DEFB	05H	1	AF		
FFDB 05	DEFB	05H	1	AF		
FFDC 05	DEFB	05H	1	AF		
FFDD 05	DEFB	05H	1	AF		
FFDE 05	DEFB	05H	1	AF		
FFDF 05	DEFB	05H	1	AF		
FFE0 05	DEFB	05H	1	AF		
FFE1 05	DEFB	05H	1	AF		
FFE2 05	DEFB	05H	1	AF		
FFE3 05	DEFB	05H	1	AF		
FFE4 05	DEFB	05H	1	AF		
FFE5 05	DEFB	05H	1	AF		
FFE6 05	DEFB	05H	1	AF		
FFE7 05	DEFB	05H	1	AF		
FFE8 05	DEFB	05H	1	AF		
FFE9 05	DEFB	05H	1	AF		
FFEA 05	DEFB	05H	1	AF		
FFEB 05	DEFB	05H	1	AF		
FFEC 05	DEFB	05H	1	AF		
FFED 05	DEFB	05H	1	AF		
FFEE 05	DEFB	05H	1	AF		
FFEF 05	DEFB	05H	1	AF		
FFF0 05	DEFB	05H	1	AF		
FFF1 05	DEFB	05H	1	AF		
FFF2 05	DEFB	05H	1	AF		
FFF3 05	DEFB	05H	1	AF		
FFF4 05	DEFB	05H	1	AF		
FFF5 05	DEFB	05H	1	AF		
FFF6 05	DEFB	05H	1	AF		
FFF7 05	DEFB	05H	1	AF		
FFF8 05	DEFB	05H	1	AF		
FFF9 05	DEFB	05H	1	AF		
FFFA 05	DEFB	05H	1	AF		
FFFB 05	DEFB	05H	1	AF		
FFFC 05	DEFB	05H	1	AF		
FFFD 05	DEFB	05H	1	AF		
FFFE 05	DEFB	05H	1	AF		
FFFF 05	DEFB	05H	1	AF		

characters that I wanted.

I started with the easiest ones first. The bell was the first to go. On one of my Model 28s, the bell code was tied to the spacing mechanism, which meant that after the character was decoded the carriage would also advance one space. That meant that no extra care would be needed here: however, my other Model 28 did not space after this code, which meant that after I printed my character in this slot I would have to immediately print a space also just to advance the carriage.

Typically, none of these special cases, excepting, of course, the space itself, will automatically advance the carriage after printing the character. You will have to check your individual machine to see if it spaces or not and adjust the program accordingly. If you really know the Model 28, there is a way you can tie these character decodes to the spacing mechanism, but this is certainly not a necessity, since it can easily be programmed around as I will show you.

I also used both upper and

lowercase blanks and perhaps the little more obscure uppercase space. Even though the uppercase space did, in fact, space after printing, it had the other side effect of automatically unshifting the carriage after printing, which also had to be programmed around.

The only really clever one was the use of the letters and figures codes themselves. If the carriage is in an unshifted position and the letters code is issued, it is essentially a NOP. This is also true if the figures code is issued and if the carriage is already in a shifted condition.

This would be a necessity if an operator had to type on the Teletype keyboard, since one slip-up would print an unwanted character. However, I considered my TRS-80 to be a nearly perfect typist and would know the condition of the carriage at all times. So I decided that if the carriage was currently unshifted and a letter code was issued, this would mean a character should be printed. If the carriage was in the un-



Photo 5. Rear view of type box with cover removed.

code was issued, then I would take that to mean that indeed a shift was intended and as such, only a shift would be done.

A similar discussion would follow in the case of the carriage being in the shifted condition. Of course these, like the other special codes, did not come with an automatic space, so a space must be output after the use of one of these codes to print a character.

After all this work, which was easier than it appeared on the

surface, I was able to add six more characters to the basic set. In fact, if you were willing to modify the Teletype mechanically, you could disconnect the function levers from the uppercase carriage return and line feed. This would add two more characters to the character set and bring you up to the theoretical maximum character set for the five-level machine. This would then allow you to print the complete Level II BASIC useful character set.

```

FFC0 20A 03178 ENBIT 1 FINISH STOP BIT
FFC1 20B 03180 NZ LOOP
FFC2 20C 03182 B,DEL 3
FFC3 20D 03184 B,DEL 4
FFC4 20E 03186 B,DEL 5
FFC5 20F 03188 B,DEL 6
FFC6 20A 03190 B,DEL 7
FFC7 20B 03192 B,DEL 8
FFC8 20C 03194 B,DEL 9
FFC9 20D 03196 B,DEL 10
FFCA 20E 03198 B,DEL 11
FFCB 20F 03200 B,DEL 12
FFCC 20A 03202 B,DEL 13
FFCD 20B 03204 B,DEL 14
FFCE 20C 03206 B,DEL 15
FFCF 20D 03208 B,DEL 16
FFD0 20E 03210 B,DEL 17
FFD1 20F 03212 B,DEL 18
FFD2 20A 03214 B,DEL 19
FFD3 20B 03216 B,DEL 20
FFD4 20C 03218 B,DEL 21
FFD5 20D 03220 B,DEL 22
FFD6 20E 03222 B,DEL 23
FFD7 20F 03224 B,DEL 24
FFD8 20A 03226 B,DEL 25
FFD9 20B 03228 B,DEL 26
FFDA 20C 03230 B,DEL 27
FFDB 20D 03232 B,DEL 28
FFDC 20E 03234 B,DEL 29
FFDD 20F 03236 B,DEL 30
FFDE 20A 03238 B,DEL 31
FFDF 20B 03240 B,DEL 32
FFE0 20C 03242 B,DEL 33
FFE1 20D 03244 B,DEL 34
FFE2 20E 03246 B,DEL 35
FFE3 20F 03248 B,DEL 36
FFE4 20A 03250 B,DEL 37
FFE5 20B 03252 B,DEL 38
FFE6 20C 03254 B,DEL 39
FFE7 20D 03256 B,DEL 40
FFE8 20E 03258 B,DEL 41
FFE9 20F 03260 B,DEL 42
FFEA 20A 03262 B,DEL 43
FFEB 20B 03264 B,DEL 44
FFEC 20C 03266 B,DEL 45
FFED 20D 03268 B,DEL 46
FFEE 20E 03270 B,DEL 47
FFEF 20F 03272 B,DEL 48
FFFA 20A 03274 B,DEL 49
FFFB 20B 03276 B,DEL 50
FFFC 20C 03278 B,DEL 51
FFFD 20D 03280 B,DEL 52
FFFE 20E 03282 B,DEL 53
FFFF 20F 03284 B,DEL 54
FFFA 20A 03286 B,DEL 55
FFFB 20B 03288 B,DEL 56
FFFC 20C 03290 B,DEL 57
FFFD 20D 03292 B,DEL 58
FFFE 20E 03294 B,DEL 59
FFFA 20A 03296 B,DEL 60
FFFB 20B 03298 B,DEL 61
FFFC 20C 03300 B,DEL 62
FFFD 20D 03302 B,DEL 63
FFFE 20E 03304 B,DEL 64
FFFA 20A 03306 B,DEL 65
FFFB 20B 03308 B,DEL 66
FFFC 20C 03310 B,DEL 67
FFFD 20D 03312 B,DEL 68
FFFE 20E 03314 B,DEL 69
FFFA 20A 03316 B,DEL 70
FFFB 20B 03318 B,DEL 71
FFFC 20C 03320 B,DEL 72
FFFD 20D 03322 B,DEL 73
FFFE 20E 03324 B,DEL 74
FFFA 20A 03326 B,DEL 75
FFFB 20B 03328 B,DEL 76
FFFC 20C 03330 B,DEL 77
FFFD 20D 03332 B,DEL 78
FFFE 20E 03334 B,DEL 79
FFFA 20A 03336 B,DEL 80
FFFB 20B 03338 B,DEL 81
FFFC 20C 03340 B,DEL 82
FFFD 20D 03342 B,DEL 83
FFFE 20E 03344 B,DEL 84
FFFA 20A 03346 B,DEL 85
FFFB 20B 03348 B,DEL 86
FFFC 20C 03350 B,DEL 87
FFFD 20D 03352 B,DEL 88
FFFE 20E 03354 B,DEL 89
FFFA 20A 03356 B,DEL 90
FFFB 20B 03358 B,DEL 91
FFFC 20C 03360 B,DEL 92
FFFD 20D 03362 B,DEL 93
FFFE 20E 03364 B,DEL 94
FFFA 20A 03366 B,DEL 95
FFFB 20B 03368 B,DEL 96
FFFC 20C 03370 B,DEL 97
FFFD 20D 03372 B,DEL 98
FFFE 20E 03374 B,DEL 99
FFFA 20A 03376 B,DEL 100
FFFB 20B 03378 B,DEL 101
FFFC 20C 03380 B,DEL 102
FFFD 20D 03382 B,DEL 103
FFFE 20E 03384 B,DEL 104
FFFA 20A 03386 B,DEL 105
FFFB 20B 03388 B,DEL 106
FFFC 20C 03390 B,DEL 107
FFFD 20D 03392 B,DEL 108
FFFE 20E 03394 B,DEL 109
FFFA 20A 03396 B,DEL 110
FFFB 20B 03398 B,DEL 111
FFFC 20C 03400 B,DEL 112
FFFD 20D 03402 B,DEL 113
FFFE 20E 03404 B,DEL 114
FFFA 20A 03406 B,DEL 115
FFFB 20B 03408 B,DEL 116
FFFC 20C 03410 B,DEL 117
FFFD 20D 03412 B,DEL 118
FFFE 20E 03414 B,DEL 119
FFFA 20A 03416 B,DEL 120
FFFB 20B 03418 B,DEL 121
FFFC 20C 03420 B,DEL 122
FFFD 20D 03422 B,DEL 123
FFFE 20E 03424 B,DEL 124
FFFA 20A 03426 B,DEL 125
FFFB 20B 03428 B,DEL 126
FFFC 20C 03430 B,DEL 127
FFFD 20D 03432 B,DEL 128
FFFE 20E 03434 B,DEL 129
FFFA 20A 03436 B,DEL 130
FFFB 20B 03438 B,DEL 131
FFFC 20C 03440 B,DEL 132
FFFD 20D 03442 B,DEL 133
FFFE 20E 03444 B,DEL 134
FFFA 20A 03446 B,DEL 135
FFFB 20B 03448 B,DEL 136
FFFC 20C 03450 B,DEL 137
FFFD 20D 03452 B,DEL 138
FFFE 20E 03454 B,DEL 139
FFFA 20A 03456 B,DEL 140
FFFB 20B 03458 B,DEL 141
FFFC 20C 03460 B,DEL 142
FFFD 20D 03462 B,DEL 143
FFFE 20E 03464 B,DEL 144
FFFA 20A 03466 B,DEL 145
FFFB 20B 03468 B,DEL 146
FFFC 20C 03470 B,DEL 147
FFFD 20D 03472 B,DEL 148
FFFE 20E 03474 B,DEL 149
FFFA 20A 03476 B,DEL 150
FFFB 20B 03478 B,DEL 151
FFFC 20C 03480 B,DEL 152
FFFD 20D 03482 B,DEL 153
FFFE 20E 03484 B,DEL 154
FFFA 20A 03486 B,DEL 155
FFFB 20B 03488 B,DEL 156
FFFC 20C 03490 B,DEL 157
FFFD 20D 03492 B,DEL 158
FFFE 20E 03494 B,DEL 159
FFFA 20A 03496 B,DEL 160
FFFB 20B 03498 B,DEL 161
FFFC 20C 03500 B,DEL 162
FFFD 20D 03502 B,DEL 163
FFFE 20E 03504 B,DEL 164
FFFA 20A 03506 B,DEL 165
FFFB 20B 03508 B,DEL 166
FFFC 20C 03510 B,DEL 167
FFFD 20D 03512 B,DEL 168
FFFE 20E 03514 B,DEL 169
FFFA 20A 03516 B,DEL 170
FFFB 20B 03518 B,DEL 171
FFFC 20C 03520 B,DEL 172
FFFD 20D 03522 B,DEL 173
FFFE 20E 03524 B,DEL 174
FFFA 20A 03526 B,DEL 175
FFFB 20B 03528 B,DEL 176
FFFC 20C 03530 B,DEL 177
FFFD 20D 03532 B,DEL 178
FFFE 20E 03534 B,DEL 179
FFFA 20A 03536 B,DEL 180
FFFB 20B 03538 B,DEL 181
FFFC 20C 03540 B,DEL 182
FFFD 20D 03542 B,DEL 183
FFFE 20E 03544 B,DEL 184
FFFA 20A 03546 B,DEL 185
FFFB 20B 03548 B,DEL 186
FFFC 20C 03550 B,DEL 187
FFFD 20D 03552 B,DEL 188
FFFE 20E 03554 B,DEL 189
FFFA 20A 03556 B,DEL 190
FFFB 20B 03558 B,DEL 191
FFFC 20C 03560 B,DEL 192
FFFD 20D 03562 B,DEL 193
FFFE 20E 03564 B,DEL 194
FFFA 20A 03566 B,DEL 195
FFFB 20B 03568 B,DEL 196
FFFC 20C 03570 B,DEL 197
FFFD 20D 03572 B,DEL 198
FFFE 20E 03574 B,DEL 199
FFFA 20A 03576 B,DEL 200
FFFB 20B 03578 B,DEL 201
FFFC 20C 03580 B,DEL 202
FFFD 20D 03582 B,DEL 203
FFFE 20E 03584 B,DEL 204
FFFA 20A 03586 B,DEL 205
FFFB 20B 03588 B,DEL 206
FFFC 20C 03590 B,DEL 207
FFFD 20D 03592 B,DEL 208
FFFE 20E 03594 B,DEL 209
FFFA 20A 03596 B,DEL 210
FFFB 20B 03598 B,DEL 211
FFFC 20C 03600 B,DEL 212
FFFD 20D 03602 B,DEL 213
FFFE 20E 03604 B,DEL 214
FFFA 20A 03606 B,DEL 215
FFFB 20B 03608 B,DEL 216
FFFC 20C 03610 B,DEL 217
FFFD 20D 03612 B,DEL 218
FFFE 20E 03614 B,DEL 219
FFFA 20A 03616 B,DEL 220
FFFB 20B 03618 B,DEL 221
FFFC 20C 03620 B,DEL 222
FFFD 20D 03622 B,DEL 223
FFFE 20E 03624 B,DEL 224
FFFA 20A 03626 B,DEL 225
FFFB 20B 03628 B,DEL 226
FFFC 20C 03630 B,DEL 227
FFFD 20D 03632 B,DEL 228
FFFE 20E 03634 B,DEL 229
FFFA 20A 03636 B,DEL 230
FFFB 20B 03638 B,DEL 231
FFFC 20C 03640 B,DEL 232
FFFD 20D 03642 B,DEL 233
FFFE 20E 03644 B,DEL 234
FFFA 20A 03646 B,DEL 235
FFFB 20B 03648 B,DEL 236
FFFC 20C 03650 B,DEL 237
FFFD 20D 03652 B,DEL 238
FFFE 20E 03654 B,DEL 239
FFFA 20A 03656 B,DEL 240
FFFB 20B 03658 B,DEL 241
FFFC 20C 03660 B,DEL 242
FFFD 20D 03662 B,DEL 243
FFFE 20E 03664 B,DEL 244
FFFA 20A 03666 B,DEL 245
FFFB 20B 03668 B,DEL 246
FFFC 20C 03670 B,DEL 247
FFFD 20D 03672 B,DEL 248
FFFE 20E 03674 B,DEL 249
FFFA 20A 03676 B,DEL 250
FFFB 20B 03678 B,DEL 251
FFFC 20C 03680 B,DEL 252
FFFD 20D 03682 B,DEL 253
FFFE 20E 03684 B,DEL 254
FFFA 20A 03686 B,DEL 255
FFFB 20B 03688 B,DEL 256
FFFC 20C 03690 B,DEL 257
FFFD 20D 03692 B,DEL 258
FFFE 20E 03694 B,DEL 259
FFFA 20A 03696 B,DEL 260
FFFB 20B 03698 B,DEL 261
FFFC 20C 03700 B,DEL 262
FFFD 20D 03702 B,DEL 263
FFFE 20E 03704 B,DEL 264
FFFA 20A 03706 B,DEL 265
FFFB 20B 03708 B,DEL 266
FFFC 20C 03710 B,DEL 267
FFFD 20D 03712 B,DEL 268
FFFE 20E 03714 B,DEL 269
FFFA 20A 03716 B,DEL 270
FFFB 20B 03718 B,DEL 271
FFFC 20C 03720 B,DEL 272
FFFD 20D 03722 B,DEL 273
FFFE 20E 03724 B,DEL 274
FFFA 20A 03726 B,DEL 275
FFFB 20B 03728 B,DEL 276
FFFC 20C 03730 B,DEL 277
FFFD 20D 03732 B,DEL 278
FFFE 20E 03734 B,DEL 279
FFFA 20A 03736 B,DEL 280
FFFB 20B 03738 B,DEL 281
FFFC 20C 03740 B,DEL 282
FFFD 20D 03742 B,DEL 283
FFFE 20E 03744 B,DEL 284
FFFA 20A 03746 B,DEL 285
FFFB 20B 03748 B,DEL 286
FFFC 20C 03750 B,DEL 287
FFFD 20D 03752 B,DEL 288
FFFE 20E 03754 B,DEL 289
FFFA 20A 03756 B,DEL 290
FFFB 20B 03758 B,DEL 291
FFFC 20C 03760 B,DEL 292
FFFD 20D 03762 B,DEL 293
FFFE 20E 03764 B,DEL 294
FFFA 20A 03766 B,DEL 295
FFFB 20B 03768 B,DEL 296
FFFC 20C 03770 B,DEL 297
FFFD 20D 03772 B,DEL 298
FFFE 20E 03774 B,DEL 299
FFFA 20A 03776 B,DEL 300
FFFB 20B 03778 B,DEL 301
FFFC 20C 03780 B,DEL 302
FFFD 20D 03782 B,DEL 303
FFFE 20E 03784 B,DEL 304
FFFA 20A 03786 B,DEL 305
FFFB 20B 03788 B,DEL 306
FFFC 20C 03790 B,DEL 307
FFFD 20D 03792 B,DEL 308
FFFE 20E 03794 B,DEL 309
FFFA 20A 03796 B,DEL 310
FFFB 20B 03798 B,DEL 311
FFFC 20C 03800 B,DEL 312
FFFD 20D 03802 B,DEL 313
FFFE 20E 03804 B,DEL 314
FFFA 20A 03806 B,DEL 315
FFFB 20B 03808 B,DEL 316
FFFC 20C 03810 B,DEL 317
FFFD 20D 03812 B,DEL 318
FFFE 20E 03814 B,DEL 319
FFFA 20A 03816 B,DEL 320
FFFB 20B 03818 B,DEL 321
FFFC 20C 03820 B,DEL 322
FFFD 20D 03822 B,DEL 323
FFFE 20E 03824 B,DEL 324
FFFA 20A 03826 B,DEL 325
FFFB 20B 03828 B,DEL 326
FFFC 20C 03830 B,DEL 327
FFFD 20D 03832 B,DEL 328
FFFE 20E 03834 B,DEL 329
FFFA 20A 03836 B,DEL 330
FFFB 20B 03838 B,DEL 331
FFFC 20C 03840 B,DEL 332
FFFD 20D 03842 B,DEL 333
FFFE 20E 03844 B,DEL 334
FFFA 20A 03846 B,DEL 335
FFFB 20B 03848 B,DEL 336
FFFC 20C 03850 B,DEL 337
FFFD 20D 03852 B,DEL 338
FFFE 20E 03854 B,DEL 339
FFFA 20A 03856 B,DEL 340
FFFB 20B 03858 B,DEL 341
FFFC 20C 03860 B,DEL 342
FFFD 20D 03862 B,DEL 343
FFFE 20E 03864 B,DEL 344
FFFA 20A 03866 B,DEL 345
FFFB 20B 03868 B,DEL 346
FFFC 20C 03870 B,DEL 347
FFFD 20D 03872 B,DEL 348
FFFE 20E 03874 B,DEL 349
FFFA 20A 03876 B,DEL 350
FFFB 20B 03878 B,DEL 351
FFFC 20C 03880 B,DEL 352
FFFD 20D 03882 B,DEL 353
FFFE 20E 03884 B,DEL 354
FFFA 20A 03886 B,DEL 355
FFFB 20B 03888 B,DEL 356
FFFC 20C 03890 B,DEL 357
FFFD 20D 03892 B,DEL 358
FFFE 20E 03894 B,DEL 359
FFFA 20A 03896 B,DEL 360
FFFB 20B 03898 B,DEL 361
FFFC 20C 03900 B,DEL 362
FFFD 20D 03902 B,DEL 363
FFFE 20E 03904 B,DEL 364
FFFA 20A 03906 B,DEL 365
FFFB 20B 03908 B,DEL 366
FFFC 20C 03910 B,DEL 367
FFFD 20D 03912 B,DEL 368
FFFE 20E 03914 B,DEL 369
FFFA 20A 03916 B,DEL 370
FFFB 20B 03918 B,DEL 371
FFFC 20C 03920 B,DEL 372
FFFD 20D 03922 B,DEL 373
FFFE 20E 03924 B,DEL 374
FFFA 20A 03926 B,DEL 375
FFFB 20B 03928 B,DEL 376
FFFC 20C 03930 B,DEL 377
FFFD 20D 03932 B,DEL 378
FFFE 20E 03934 B,DEL 379
FFFA 20A 03936 B,DEL 380
FFFB 20B 03938 B,DEL 381
FFFC 20C 03940 B,DEL 382
FFFD 20D 03942 B,DEL 383
FFFE 20E 03944 B,DEL 384
FFFA 20A 03946 B,DEL 385
FFFB 20B 03948 B,DEL 386
FFFC 20C 03950 B,DEL 387
FFFD 20D 03952 B,DEL 388
FFFE 20E 03954 B,DEL 389
FFFA 20A 03956 B,DEL 390
FFFB 20B 03958 B,DEL 391
FFFC 20C 03960 B,DEL 392
FFFD 20D 03962 B,DEL 393
FFFE 20E 03964 B,DEL 394
FFFA 20A 03966 B,DEL 395
FFFB 20B 03968 B,DEL 396
FFFC 20C 03970 B,DEL 397
FFFD 20D 03972 B,DEL 398
FFFE 20E 03974 B,DEL 399
FFFA 20A 03976 B,DEL 400
FFFB 20B 03978 B,DEL 401
FFFC 20C 03980 B,DEL 402
FFFD 20D 03982 B,DEL 403
FFFE 20E 03984 B,DEL 404
FFFA 20A 03986 B,DEL 405
FFFB 20B 03988 B,DEL 406
FFFC 20C 03990 B,DEL 407
FFFD 20D 03992 B,DEL 408
FFFE 20E 03994 B,DEL 409
FFFA 20A 03996 B,DEL 410
FFFB 20B 03998 B,DEL 411
FFFC 20C 04000 B,DEL 412
FFFD 20D 04002 B,DEL 413
FFFE 20E 04004 B,DEL 414
FFFA 20A 04006 B,DEL 415
FFFB 20B 04008 B,DEL 416
FFFC 20C 04010 B,DEL 417
FFFD 20D 04012 B,DEL 418
FFFE 20E 04014 B,DEL 419
FFFA 20A 04016 B,DEL 420
FFFB 20B 04018 B,DEL 421
FFFC 20C 04020 B,DEL 422
FFFD 20D 04022 B,DEL 423
FFFE 20E 04024 B,DEL 424
FFFA 20A 04026 B,DEL 425
FFFB 20B 04028 B,DEL 426
FFFC 20C 04030 B,DEL 427
FFFD 20D 04032 B,DEL 428
FFFE 20E 04034 B,DEL 429
FFFA 20A 04036 B,DEL 430
FFFB 20B 04038 B,DEL 431
FFFC 20C 04040 B,DEL 432
FFFD 20D 04042 B,DEL 433
FFFE 20E 04044 B,DEL 434
FFFA 20A 04046 B,DEL 435
FFFB 20B 04048 B,DEL 436
FFFC 20C 04050 B,DEL 437
FFFD 20D 04052 B,DEL 438
FFFE 20E 04054 B,DEL 439
FFFA 20A 04056 B,DEL 440
FFFB 20B 04058 B,DEL 441
FFFC 20C 04060 B,DEL 442
FFFD 20D 04062 B,DEL 443
FFFE 20E 04064 B,DEL 444
FFFA 20A 04066 B,DEL 445
FFFB 20B 04068 B,DEL 446
FFFC 20C 04070 B,DEL 447
FFFD 20D 04072 B,DEL 448
FFFE 20E 04074 B,DEL 449
FFFA 20A 04076 B,DEL 450
FFFB 20B 04078 B,DEL 451
FFFC 20C 04080 B,DEL 452
FFFD 20D 04082 B,DEL 453
FFFE 20E 04084 B,DEL 454
FFFA 20A 04086 B,DEL 455
FFFB 20B 04088 B,DEL 456
FFFC 20C 04090 B,DEL 457
FFFD 20D 04092 B,DEL 458
FFFE 20E 04094 B,DEL 459
FFFA 20A 04096 B,DEL 460
FFFB 20B 04098 B,DEL 461
FFFC 20C 04100 B,DEL 462
FFFD 20D 04102 B,DEL 463
FFFE 20E 04104 B,DEL 464
FFFA 20A 04106 B,DEL 465
FFFB 20B 04108 B,DEL 466
FFFC 20C 04110 B,DEL 467
FFFD 20D 04112 B,DEL 468
FFFE 20E 04114 B,DEL 469
FFFA 20A 04116 B,DEL 470
FFFB 20B 04118 B,DEL 471
FFFC 20C 04120 B,DEL 472
FFFD 20D 04122 B,DEL 473
FFFE 20E 04124 B,DEL 474
FFFA 20A 04126 B,DEL 475
FFFB 20B 04128 B,DEL 476
FFFC 20C 04130 B,DEL 477
FFFD 20D 04132 B,DEL 478
FFFE 20E 04134 B,DEL 479
FFFA 20A 04136 B,DEL 480
FFFB 20B 04138 B,DEL 481
FFFC 20C 04140 B,DEL 482
FFFD 20D 04142 B,DEL 483
FFFE 20E 04144 B,DEL 484
FFFA 20A 04146 B,DEL 485
FFFB 20B 04148 B,DEL 486
FFFC 20C 04150 B,DEL 487
FFFD 20D 04152 B,DEL 488
FFFE 20E 04154 B,DEL 489
FFFA 20A 04156 B,DEL 490
FFFB 20B 04158 B,DEL 491
FFFC 20C 04160 B,DEL 492
FFFD 20D 04162 B,DEL 493
FFFE 20E 04164 B,DEL 494
FFFA 20A 04166 B,DEL 495
FFFB 20B 04168 B,DEL 496
FFFC 20C 04170 B,DEL 497
FFFD 20D 04172 B,DEL 498
FFFE 20E 04174 B,DEL 499
FFFA 20A 04176 B,DEL 500
FFFB 20B 04178 B,DEL 501
FFFC 20C 04180 B,DEL 502
FFFD 20D 04182 B,DEL 503
FFFE 20E 04184 B,DEL 504
FFFA 20A 04186 B,DEL 505
FFFB 20B 04188 B,DEL 506
FFFC 20C 04190 B,DEL 507
FFFD 20D 04192 B,DEL 508
FFFE 20E 04194 B,DEL 509
FFFA 20A 04196 B,DEL 510
FFFB 20B 04198 B,DEL 511
FFFC 20C 04200 B,DEL 512
FFFD 20D 04202 B,DEL 513
FFFE 20E 04204 B,DEL 514
FFFA 20A 04206 B,DEL 515
FFFB 20B 04208 B,DEL 516
FFFC 20C 04210 B,DEL 517
FFFD 20D 04212 B,DEL 518
FFFE 20E 04214 B,DEL 519
FFFA 20A 04216 B,DEL 520
FFFB 20B 04218 B,DEL 521
FFFC 20C 04220 B,DEL 522
FFFD 20D 04222 B,DEL 523
FFFE 20E 04224 B,DEL 524
FFFA 20A 04226 B,DEL 525
FFFB 20B 04228 B,DEL 526
FFFC 20C 04230 B,DEL 527
FFFD 20D 04232 B,DEL 528
FFFE 20E 04234 B,DEL 529
FFFA 20A 04236 B,DEL 530
FFFB 20B 04238 B,DEL 531
FFFC 20C 04240 B,DEL 532
FFFD 20D 04242 B,DEL 533
FFFE 20E 04244 B,DEL 534
FFFA 20A 04246 B,DEL 535
FFFB 20B 04248 B,DEL 536
FFFC 20C 04250 B,DEL 537
FFFD 20D 04252 B,DEL 538
FFFE 20E 04254 B,DEL 539
FFFA 20A 04256 B,DEL 540
FFFB 20B 04258 B,DEL 541
FFFC 20C 04260 B,DEL 542
FFFD 20D 04262 B,DEL 543
FFFE 20E 04264 B,DEL 544
FFFA 20A 04266 B,DEL 545
FFFB 20B 04268 B,DEL 546
FFFC 20C 04270 B,DEL 547
FFFD 20D 04272 B,DEL 548
FFFE 20E 04274 B,DEL 549
FFFA 20A 04276 B,DEL 550
FFFB 20B 04278 B,DEL 551
FFFC 20C 04280 B,DEL 552
FFFD 20D 04282 B,DEL 553
FFFE 20E 04284 B,DEL 554
FFFA 20A 04286 B,DEL 555
FFFB 20B 04288 B,DEL 556
FFFC 20C 04290 B,DEL 557
FFFD 20D 04292 B,DEL 558
FFFE 20E 04294 B,DEL 559
FFFA 20A 04296 B,DEL 560
FFFB 20B 04298 B,DEL 561
FFFC 20C 04300 B,DEL 562
FFFD 20D 04302 B,DEL 563
FFFE 20E 04304 B,DEL 564
FFFA 20A 04306 B,DEL 565
FFFB 20B 04308 B,DEL 566
FFFC 20C 04310 B,DEL 567
FFFD 20D 04312 B,DEL 5
```


MAKE YOUR **TRS-80** A 3-SPEED

This simple addition allows either normal operation, a 50% increase, or a 50% decrease in CPU speed. Unlike other speed mods, this one may be changed AT ANY TIME without interrupting program execution. This is critical in machine language programs where there's no software access. Shortens calculations, sorts, and CLOAD and CSAVE times. The low speed simplifies de-bugging, slows a Level II LIST, and ELIMINATES KEY-BOUNCE without software overhead. Fits inside the keyboard unit with only 4 easily accessible connections, and is easily removed if the computer ever needs service. The Mumford Micro 3-speed kit has been field proven by its many users and complete satisfaction is guaranteed. Kit includes all parts and clearly illustrated instructions for \$24.95. Fully assembled and tested . . . \$29.95

DUPLICATE SYSTEM TAPES WITH "CLONE"

This machine language program makes duplicate copies of ANY tape written for Level II. They may be SYSTEM tapes (continuous or not) or data lists. It is not necessary to know the file name or where it loads in memory, and there is no chance of system co-residency. The file name, entry point, and every byte (in ASCII format) are displayed on the video screen. Data may be modified before copy is produced. CLONE . . . \$16.95

RAM TEST FOR LEVEL II

This machine language program tests memory chips for open or shorted address or data lines as well as intermittents. It tests each BIT for validity and each BYTE in the execution of an actual instruction as in real program execution. Bad addresses are displayed along with the bad data and proper data. One complete test of 48K takes just 14 seconds. Also includes a test for errors induced by power line glitches from external equipment. RAMTEST . . . \$9.95

PROGRAM INDEX FOR DISK BASIC

Assemble an alphabetized index of your entire program library from disk directories. Program names and free space are read automatically (need not be typed in) and may be alphabetized by disk or program. The list may also be searched for any disk, program, or extension, disks or programs added or deleted, and the whole list or any part sent to the printer. Finally, the list itself may be stored on disk for future access and update. One drive and 32K required. INDEX . . . \$19.95

EDIT BASIC PROGRAMS WITH ELECTRIC PENCIL

This program allows disk users to load Basic programs into the disk version of Electric Pencil for editing. Now you can edit line numbers, move program segments, and search for the occurrence of any group of characters. PENPATCH . . . \$9.95

INCLUDE 75¢ POSTAGE—CALIFORNIA RESIDENTS ADD 8% SALES TAX

MUMFORD MICRO SYSTEMS

✓ M07

BOX 435-C SUMMERLAND, CALIFORNIA 93067
(805) 969-4557

COMING SOON: **PRISM** T.M.

The Complete Information Management System For Business

Another Business Solution From:

MAG

MICRO APPLICATIONS GROUP
7300 CALOUS AVENUE
VAN NUYS, CA 91406

I have not modified my Teletype yet, so I can only choose six characters (out of my desired eight) to add to my character set. Of the eight characters that I previously mentioned were missing, I chose to leave out the @ and f. In place of the @, I decided to just output a space, and in place of the f, I used !. If you wanted to be a bit tricky, you could have the driver routine print the letters AT each time it was supposed to print an @. These extra type keys (called pallets—see Photo 6) can be obtained from the Teletype service center for about 50 cents apiece.

The modification of the type box is very easy. The type box is held in place by a clip to the right-hand side of the type box as shown in Photo 3. Once the type box has been removed from the Teletype, remove the two bolts on either side of the type box (Photo 4) and remove the back cover (Photo 5). In Photo 6, you will see the hooked end of the spring that is normally inserted into the slot on the pallet as is pointed out in Photo 5. To install a new pallet, insert the pallet with no spring attached into the appropriate hole as shown in Photo 4, then slide the spring over the pallet and push the hooked part of the spring through the hole in the pallet as shown in Photos 5 and 6. Reassemble the type box to complete the modification.

Now that you have seen how I modified the Model 28 type box and how it will work, let's take a brief look at Listing 4 to see how the software has to handle it. Again, the first part of the program should be familiar since it is another copy of the handler routine. The label ORIGIN again defines the beginning of the lookup table, which has been a little better documented in order to help you change the character translation easily. In the first routine, I used blanks (40 hex) as the translation for illegal characters. However, in this routine, I cannot do that since I have made the blank a printable character. So for the illegal characters, I just output a lower-case space, which now is the

only character that for sure will not print any character on the paper.

For the most part, the labels in this routine have similar meanings to the labels in the first driver routine. The label PRCENT signifies the beginning of special character checking. A jump to the SPACIT label will print the character and then output a space. This is used after a character that does not automatically advance the carriage is printed. The label ASTER is the check for an asterisk. It is a good example of this need since it is the unshifted letters code, which does not automatically advance the carriage after printing. You can see that as soon as the asterisk is detected a jump is made to the SPACIT label.

This example gives you the tools you need to use any character decode that does not automatically advance the carriage by adding a similar check for that character into the code. A good place to add any additional checks that you might need would be immediately before the ASTER label. For instance, on my Model 28, the up-percase blank (now a >) and the bell both advanced the carriage automatically so I didn't need to do any checking for them. However, it is possible that your Teletype may not advance the carriage automatically. In that case, you would need to add two checks for these decodes immediately before the ASTER label.

Although the first driver routine was relocatable anywhere in memory, this one is not. In order to move this one around, you must assemble it at the desired location.

After you understand how the program works, you can logically extend this knowledge to develop an even simpler program to communicate with other Teletype machines (e.g., the ASR-33 Teletype). Most of the other Teletypes are ASCII, which means that no lookup table is required, and which additionally means that no shifting is required to print any of the characters. ■

Great News from HMCT



TRS-80* MODEL I AND MODEL II IN STOCK

Before you purchase your TRS-80* Model I and Model II from your local Radio Shack, or consider Mail order for a discount, let me offer you an alternate choice. Houston Micro Computer Technologies, Inc. has been providing TRS-80 Software and Hardware to hundreds of users for almost 2 years. We are not a mass merchandiser nor are we a discount house, but a group of professionals dedicated to helping businesses implement microcomputers to their greatest advantage. Here are just a few of the advantages we offer over Radio Shack.

DELIVERY	Less than 30 days**
RELIABILITY	Each unit 100% tested prior to delivery
SATISFACTION	Sold by computer professionals who understand what you need your computer to do
VALUE	Trade in value on Model I systems dependent upon condition and configuration
SERVICE	National service on all products we sell including TRS-80s*

CONFIGURATION

As a distributor for many lines of computer peripherals we can tailor your system to your exact hardware requirements. We are an already established Model I Systems House with an extensive software library.

SOFTWARE

Maybe you believe a mass merchandising organization or a discount operation is who you should trust your computer hardware selection to. Personally we like to think you would prefer to deal with specialists and professionals who will spend the time with you personally or on the phone to assist you in your choice of equipment based on your needs and specifications.

All equipment purchased from Houston Micro Computer Technologies, Inc. is fully warranted and backed by national service organizations including Radio Shack.

For further information call collect, **713/661-2005** or write.

** Delivery of Model II subject to availability.

*TRS-80 is a registered trademark of the Tandy Corporation.

Texas residents add 6% sales tax • MasterCharge • Visa

HOUSTON MICRO-COMPUTER TECHNOLOGIES, INC.

Home and Business Computer Specialists

5313 BISSENET • BELLAIRE • TEXAS • 77401 • 713/661-2005

✓ H45

A Video Board from Ithaca Intersystems

Good luck with Ithaca's memory kits prompted this author to choose an I/O memory board.

Ernie Brouner
Box 236
Lakeside MT 59922

When putting together my first micro, I was greatly confused by the available I/O choices. I remember wondering, for example, why some terminals were self-contained, while others used separate keyboards and video boards and why some were serial and others parallel.

Being familiar with Teletype practices, I finally chose what is commonly referred to as a "glass Teletype," or, more imprecisely, a "dumb terminal." Interfacing this device required plugging a separate I/O board into the S-100 bus. I soon learned that computer I/O can be frightening in any form, largely because I chose the Im-sai MIO with its now infamous documentation. In retrospect, however, I have to admit that it has good hardware.

Although serving well for business use, such an arrangement does not fully exploit the available technology for such uses as graphics and text-pro-

cessing; hence, sooner or later, I felt it necessary to go the route of completely separate video processing, via a board internal to the micro itself and some slightly sophisticated software to permit on-screen editing, among other features. I had long wanted lowercase characters, too, and the 8x10 matrix of Ithaca's product even permitted descenders on those letters needing tails.

Choosing a Video Board

We hobbyists are sometimes accused of being frugal. Having had good results with Ithaca Intersystems' low-priced memory kits, I chose their video board largely on the basis of price.

One of Ithaca Intersystems' greatest selling points is their willingness to sell the bare board and documentation for a reasonable cost, so that the builder may use his own surplus parts to populate the kit or buy them wherever he feels the deal is best. This can result in reasonably priced hardware if you have access to free or inexpensive spare parts. (Ithaca's video boards and memory board go for \$25 each, with full documentation.) If you wish, you can also

purchase the fully assembled video board for \$145.

One look at this board indicates that Ithaca Intersystems is a company whose already good products have improved with time. A few years ago their boards could be described as good enough for the price; now the engineering and the board itself appear to be of the highest quality. And after \$3000 worth of S-100 components, with their usually inadequate and/or erroneous documentation, this one was a pleasant surprise.

In addition to clear descriptions of the circuitry and easy-to-read diagrams, there was a request for comments and suggestions from the user. Unfortunately, I did have to be a little bit critical. There were a few errors, such as disparities between the diagram and parts lists. Most builders could make an intelligent guess on these.

Missing was any description of actually using the board. And the otherwise outstanding software furnished used some labels and some absolute addresses, posing a slight reassembly problem for anyone not proficient at such chores.

Evaluating computer com-

ponents is subjective and often depends on what the buyer is already using. For example, some video boards provide a parallel keyboard port on the board itself; this one does not. This is of little importance to me, since I have a separate keyboard/terminal and I/O board already incorporated in my system, but it could influence the decision of someone starting from scratch to assemble a system. The point is that any such system requires data to be input and data to be output. These are really separate functions, even though they are often combined for hardware purposes.

As purchased from Ithaca Intersystems for \$25, the kit consists of the blank, etched and labeled board, the assembly instructions, a few debugging suggestions and the necessary software. If you carelessly buy good-quality parts, you might spend another \$100 to complete the project. More realistically, the total cost for the project, over and above the initial \$25, is \$75, which was my total cost for the board and everything else I had to purchase.

The kit instructions advise

the builder to omit heat sinks on the two 7805 voltage regulators. I used them anyway, but, with low-power chips, they are not really necessary. Total drain from the user's supply is between 1/2 and 1 Amp.

Another hardware subject to note (not just for this, but for any S-100 project) is the bus signals actually used or generated by the new item. Most of us have run into this sort of compatibility problem at some time. This one should be compatible with almost anything, but it does require the read and write signals, In, Out, Dbln, clock phase 2 and Sync. It also must access all address lines, the data in and data out lines, both the ± 16 volt supplies and the 8 volt supply.

The board gets its input from the bus; the output to your TV or monitor is via a small coax cable. This output consists of the characters plus the horizontal and vertical sync signals. A worthwhile mod the user can make is to put a miniature connector at one corner of the board to facilitate this connection.

Use of the Board and Software Driver

For those not familiar with such projects, the arrangement consists of 1K of memory on the board, which is addressed somewhere above the "real" memory. Ithaca Intersystems indicates this can be located almost anywhere. Actually, some software, such as most versions of Electric Pencil, require the video display to be at C000H, and the driver also assumes this. Such references must, of course, be changed if addressed anywhere else.

Software is really the key to what can be accomplished with a device like this. Features include the ability to back up the cursor and thus erase a mistake and control the speed of the scrolling action. The CPU and main memory are also communicated with so that actions by either the board system or the rest of the system will agree.

This particular board, like many others, also lets the user

select a white-on-black or black-on-white display. It also enables you to use more exotic software that requires memory-mapped video. Electric Pencil is one of the best known of these.

When first fired up, this board wants to see a form-feed (control L) as the first character. This is necessary to clear the screen of the pretty, random display of any printable or, for that matter, unprintable characters that are in memory. Unprintables are not X-rated—they are the ASCII representation of spaces and carriage returns, for example. Your driver must supply this initialization routine.

As is often the case, it also wants this character, and all succeeding ones, in the A register. Most operating systems pass this from some other register just prior to printing. North Star likes B, and CP/M likes C. I am not familiar with any other specific systems.

In addition to clearing the screen, the initialization sets the bounds of the top and bottom line and sets up the scrolling arrangement. After this, output can be more or less normally handled, and the video and CPU will remain on good terms.

How It Works

Characters are placed in the appropriate memory cell representing the particular spot on the screen where the character will appear. The cursor can also be caused to appear anywhere and occupies the entire rectangle representing that space; however, there is no conflict between cursor and character.

If you have selected black letters on a white background, the cursor block will also be black; however, the letter that may happen to be hiding beneath the cursor is, at that time, reversed and appears as a white letter outlined against the black cursor. Hence, no display is ever obliterated by the cursor, even though it is a solid block.

It happens like this: The character generator chip is simply a ROM with the ASCII code for

each character programmed into it; calling any address within it returns the necessary dot pattern to paint the desired character on the screen. The ASCII pattern uses only the lower bits, and bit seven is reserved for the cursor; hence, any screen location can contain, at the same time, both the cursor and a character. Needless to say, the timing among the dot generator, screen sweep signals and character is critical. For this reason, all timing is derived from an on-board crystal oscillator.

Most of the needed parts can be found in computer stores or radio parts houses. There are a few exceptions. Two or three of the chips, such as the character generator, are more or less uncommon. If you cannot locate one readily, Ithaca Intersystems sells them, as well as the dot generator crystal and the single resistor pack. (You can as easily use half a dozen resistors as the pack, but it looks nicer.) Two other not-so-common items are the trimpots used to adjust the centering of the video display on the monitor.

The hardware is fairly simple in view of the construction notes provided with the kit. Checkout is feasible with nothing more than a VOM and a logic probe, unless there are serious timing problems, in which case you send it back to Ithaca for help. My recommendation is to add it to the existing system, if there is one, without attempting to actually use it.

It should be possible, if it is all there, to use your FILL or POKE commands, depending on your version of BASIC (or even panel switches) to place ASCII characters in the memory cells within the bounds of the video board (i.e., 52 to 53K, if that is where you put it). They should then display on the screen. If not, some troubleshooting is in order.

If this can be accomplished, there is nothing left to do but write the software. Not meaning to frighten anyone, this is best done with the help of someone who has an assembler and/or is familiar with as-

sembly-language programming. It will actually work right if entered exactly as it is, provided you are using all the same addresses.

The software driver furnished with the kit runs to over 200 bytes. Squeezing it into your own system might pose a problem, as there must still be room for your input and initialization procedures. North Star, for example, allows the user 250 bytes for this purpose. CP/M has twice that, and other systems, no doubt, vary.

I chose to relocate my printer driver as a separate file for use with North Star. This is not necessary with a larger user area such as that provided by CP/M. Some pruning could be done to save space, but each portion removed could disable some desirable feature.

The attractive thing about such a system, when installed intact, is that it permits the continuous checking for various control characters that enable the additional user control and flexibility.

Summary

This board represents an excellent buy for people wanting to include a video display in their repertoire. Neither the hardware nor associated software is especially difficult, although a beginner would be well advised to have some initial help with them. It also helps to have some other operating system already in existence, as an aid to the debugging that may be needed.

Ithaca Intersystems is ready to help, as witnessed by their request for comments and their offer, in the documentation, to fix any board that is beyond the test-equipment capability of the builder. All video boards are limited in their display to some fixed number of lines on the screen and number of characters per line (24 by 80 is considered a nice size). The Ithaca Intersystems board, along with many on the market, has 16 lines by 64 columns. It's simply a case of getting what you can afford to pay for. If a 16-line display is all you really need, by all means try this one. ■

Route 66 Modem

A modem links your microcomputer to anyplace that has a telephone. Get on the road to high adventure with this economical design.

Frank J. Derfler, Jr.
PO Box 17283
Montgomery AL 36117

Back in the innocent(?) early 60s, almost every high-school-age male in the Middle West had the "Route 66" fantasy. We dreamed of rolling off down Route 66 in a fast Corvette in search of romance, adventure and knowledge.

Well, today we aren't even taking any long trips, let alone fast ones. But we can still extend ourselves into the world in search of knowledge, adventure and maybe even romance. We can extend our computer selves through the use of a modem and the regular tele-

phone lines. The price of the modem I will describe adds up to \$66 if you pay full retail. Therefore, I call it the Route 66 modem.

Commercial modems are expensive. When you consider what they do and the price of the parts, the typical \$200+ price tag is pretty steep. Perhaps the gravy in the simple modems is paying for the R&D of the exotic high-speed error detection and correction units, but I don't want to pay the tariff for a simple audio-to-dc converter.

My answer is to send an order off to a company called Electronic Systems, which usually has an ad in the back of *Microcomputing*, for a \$27.50 modem kit. The modem has a TTL output, but they also have

an inexpensive TTL/RS-232 board, so it will interface to most terminals or computers. A power supply and enclosure are needed to complete the package. Access to a frequency counter and audio oscillator is almost a must for alignment.

I chose to get the cabinet and power supply parts from Radio Shack because they were handy. If you order from some of the parts houses advertising in the back of the magazine, you may be able to put the originate-only modem together for under \$50.

Theory

A modem is a communications device. It takes the output from your computer or terminal (usually a ± 12 volt signaling scheme called RS-232) and converts it into audio tones that can be passed over the phone lines. Another modem is at the other end of the phone line.

The second modem converts the tones back into dc, which it feeds into its computer or terminal. This means that you can (theoretically) talk to and exchange programs with people with other brands of systems than the one you own.

For example, an OSI Challenger and a TRS-80 may both be using similar Microsoft BASIC, but that doesn't mean they can swap programs on cassettes. The cassette systems are different. But if they both use a common RS-232 ASCII format, they can exchange in-

formation over a telephone or wireline. It is more complex than that because they should have some way to save what they receive, but there are software routines available to do this already.

Originate and Answer

If the modems at either end of the line are both pumping out tones at the same time, then it becomes obvious that they can't both use the same tones, or they will hear only themselves. Four tones are needed so that the high and low dc pulses can be converted into separate high and low tones at each end.

Several standards exist for what tones will be used, but the most common is the Bell 103. This standard says that the modem that is on the terminal end (in a time-sharing system, for instance) will use 2225 and 2025 Hz for transmit. This is called the "originate" modem. The modem on the computer end of a time-sharing system (the "answer" modem) transmits at 1270 and 1070 Hz.

Many hobby computer users have been unpleasantly surprised when they have bought or built low-priced modems that were originate only. Two originate modems cannot talk to each other. Most kits that advertise "originate or answer" (including the Electronic Systems kit used here) must be hard-wired in either configuration. It is hardly a convenient



The layout of the modem is not critical. The operating controls are simple. The switch on the panel selects either the answer or originate modem board.

way to do it, but by using two of the kits with a common power supply and other parts, we can have both capabilities at a low price.

The Kits

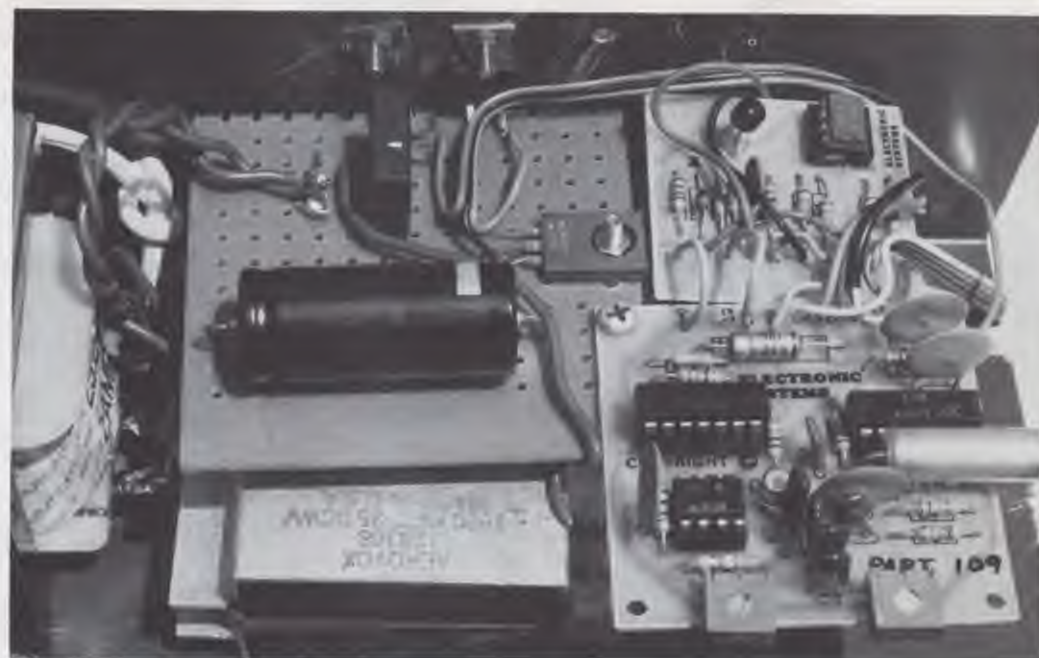
Electronic Systems will take credit-card orders when the phone rates are low. My order was shipped the next day. Both kits (shown in the parts list) were complete with sockets for the ICs. Construction required just stuffing the parts into the holes and soldering.

The 2N2222 transistor supplied with the TTL/RS-232 kit had a round case without a tab, so I had to use a VOM to find out which leads were the emitter/base junction. I felt that this assumed a sophistication on the part of the builder which might not be present. The modem kit had a properly marked 2N2222. The markings on the little Mylar capacitors rub off quickly, so don't touch their flat sides or you will have a pretty puzzle to work out.

The modem kit came with excellent documentation that described the operation of both the transmit and receive sides. Select the proper components for either originate or answer. Stuffing and soldering the kit boards is about a two hour job, if you take time out to read the directions.

Phone Line Connection

The modem kit calls for a high-impedance input such as a crystal mike and a low-impedance output such as a speaker. This could be provided in several ways. First, you could spend a few dollars for a crystal mike



The modem board is lower right with the TTL/RS-232 board above it. The power-supply components are mounted on the board on the left. The two positive voltage regulators are on the chassis wall. The negative regulator must be insulated from the chassis. The two modem boards are stacked on top of each other. The modems are grounded through their mounting screws.

and a speaker and build them into a stand that would hold a telephone handset.

Second, you could buy an audio pick-up such as the one advertised by the Roudure Company for \$17.50. Third, you could, as I did, find an old amateur-radio phone patch and use it to couple into the phone line. Finally, you could buy two 99 cent transformers and couple into the phone line that way (as shown in Fig. 1).

A word of note: If you direct-couple into the phone line with a phone patch or the transformer system, you will be required to get the phone company to install something called a direct access arrangement (DAA),

which stops unwanted tones from going down the phone lines and fouling up the telephone company's switching systems.

Interfacing

The output of the modem board is transistor-transistor logic (TTL), which is a system of signaling using +5 and 0 volts. Some terminals can use TTL levels. If you have one of these, then you don't need the TTL/RS-232 board. (See "Parallel Port to RS-232," April 1979 *Microcomputing*.)

Electronic Systems also has a TTL/20 mA current loop board, so if you are using a terminal such as a Model 33 you can use this interface. The majority of terminals and computers use an RS-232 interface.

When you make up the con-

necting cable, you must decide if you are going to plug into a computer or a terminal. This is important for several reasons. First, a computer has a female RS-232 jack mounted on its chassis; a terminal has a male. Second, the standard is set up so that a computer expects to receive data (from terminal 5 of the RS-232 board) on its pin 2 and to transmit data (to terminal 2 on the board) on its pin 3. A terminal outputs on 2 and receives on 3 so that it mates with a computer.

As the modem builder, you have to decide which device you need to mate to. If you want flexibility, then simply prepare two different cables that plug into a jack on the modem. In either case, pins 4 and 5 of the DB25 plug should be wired together so the device provides its

Modem kit: Electronic Systems Part No. 109A
TTL/RS-232 Converter: Electronic Systems RS-232
DB25P Plug: Available from Jameco Electronics or with an 8 conductor cable from Electronic Systems, PO Box 21638, San Jose CA 95151.

Item	Radio Shack Part No.
Neon panel light	272-705
Aluminum cabinet (3.5 x 9 x 6)	272-261
VR1 +5 volt regulator (7805)	276-1770
VR2 +12 volt regulator (7812)	276-1771
VR3 -12 volt regulator (7912)	NOT LISTED
D1 4 AMP 50 V bridge	276-1146
C1, C2 2200 uFd capacitor	272-1020
S1 SPST switch	275-011
Ac power cord	278-1255
T1 transformer 25.2CT 2 Amp	273-1512

Parts List.



Fig. 1. This circuit can be used to connect the modem board to the phone line. T3 and T4 are two identical Radio Shack audio output transformers (stock no. 273-1380) with their secondaries hooked together. The capacitors keep any stray dc voltages out of the transformer.



The modem tucks in neatly under the monitor. The old phone patch used to couple into the phone line is on the left.

own clear-to-send signal.

Power Supply

The power supply I've shown (Fig. 2) provides all the voltages needed with an absolute minimum of parts. The bridge rectifier isn't working as a bridge; it is working as two separate full-wave rectifiers in one convenient package—one for +12 and one for -12 volts. The +5 volts is tapped from the +12 volt source. The -12 volt regulator isn't a standard item in the Radio Shack catalog, but many stores now carry them.

The photographs show the general layout I used. I just mounted everything on a piece of perforated board and used point-to-point wiring underneath. The components run cool and can handle two modem boards with no problem.

Double Talk

If you only use one modem board, then you will have either an answer or originate capability.

If you know exactly who you are going to talk to, this may be enough. But to be truly versatile, you need both capabilities. Although Electronic Systems gives you the right parts for either format, there are too many connections and alignments involved for easy switching.

The best way is to buy two modem boards, set one up for answer and one for originate, connect the audio and power-supply lines to both in parallel and switch the TTL input and output lines between the two modem boards with a simple DPDT switch. Doing it is easier than writing about it, and the diagram for the switching is Fig. 3.

Alignment

If you have a friend with a modem and a lot of patience, it is possible to align this system by slowly turning the trimpots until you are sending and receiving good copy. The only adjustment consists of one pot

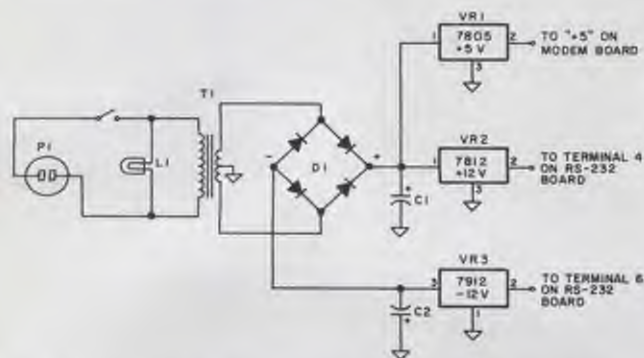


Fig. 2. This power supply is simple and effective. The bridge is being used as two full-wave rectifiers. Note that the pins are different on the negative regulator and that it must be insulated from the chassis.

Tone	Logic	TTL Level	RS-232	TTY State
2225 Hz	One	+5	-12	Mark
2025 Hz	Zero	0	+12	Space
1270 Hz	One	+5	-12	Mark
1070 Hz	Zero	0	+12	Space

(1270 and 1070 are received by an originate modem)
(2225 and 2025 are received by an answer modem)

Table 1. Tone/level table.

each for the transmit and receive frequencies. The tolerance is about 10 percent or 100 to 200 Hz, so you have to be close. A frequency counter really helps. I used a shortwave receiver with a beat note on the crystal calibrator for a signal generator.

These modems are not crystal controlled, so try to set the unit up under fairly standard temperature conditions. Some drifting with age may take place. The only problems I have are with some other 300 baud modems on the end of some phone lines on some days. It isn't consistent. Usually, switching down to 110 baud improves the reliability of communications.

What Do You Say After Hello?

Now that you can get information into your machine, what can you do with it? If you are using a terminal, you might print it out on an attached printer. But many of us want to use our computers to communicate and then to manipulate what we received.

In the easiest form, you can stay in BASIC while someone at the other end talks to you in the form of line numbers and REM statements that will keep BASIC from issuing error messages. You can then save the text and programs you received in your normal way. That is probably good enough to converse with your friends, but don't expect a time-sharing system to talk to you in REM statements. You could write a BASIC program to allow free-flow discussion, but you would need a files capability to save what you got. This is not available on most cassette systems.

Radio Shack is advertising a communications software package for the TRS-80 under cata-

log number 26-1146. Jim Dvorak (see "Who Sells Software?" April 1979 *Microcomputing*, p. 48) has recently been advertising a useful program for North Star users. With a program that will allow you to talk in plain text "terminal mode" to a larger computer and then to save whatever you receive, you can literally suck the larger systems dry of interesting programs that they will let you list.

One minor operating point: When your modem is not receiving a signal, it will sit at rest in either the logic zero (space) or the logic one (mark) state (see Table 1). If it comes to rest on a logic zero, it will drive your computer frantic. If you are operating with a time-share system as an originate modem, don't turn your modem on until you hear the other system first. Then act promptly or you might time out.

If you are serving as an answer modem for someone who has a commercial originate modem, you may have to give him a tone first so that it opens his transmit line. In this case you might get some garble until your modem is in synch. That is a small price to pay for the capability to send and receive computer-to-computer information. ■

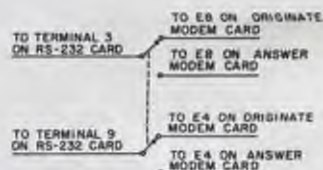


Fig. 3. If you need both an answer and originate modem, a simple DPDT switch will allow you to switch the TTL inputs and outputs from either modem board into the TTL/RS-232 board. The power and audio leads are hooked to both boards in parallel.

**RADIO SHACK COMPUTER OWNERS
TRS-80 MODEL I AND MODEL II**

TRS-80TM MONTHLY NEWSLETTER

- PRACTICAL APPLICATIONS
- BUSINESS
- GAMBLING • GAMES
- EDUCATION
- PERSONAL FINANCE
- BEGINNER'S CORNER
- NEW PRODUCTS
- SOFTWARE EXCHANGE
- MARKET PLACE
- QUESTIONS AND ANSWERS
- PROGRAM PRINTOUTS
- AND MORE

**PROGRAMS AND ARTICLES PUBLISHED IN OUR FIRST 12 ISSUES
INCLUDE THE FOLLOWING:**

- A COMPLETE INCOME TAX PROGRAM (LONG AND SHORT FORM)
- INVENTORY CONTROL
- STOCK MARKET ANALYSIS
- WORD PROCESSING PROGRAM (FOR DISK OR CASSETTE)
- LOWER CASE MODIFICATION FOR YOUR VIDEO MONITOR OR PRINTER
- PAYROLL (FEDERAL TAX WITHHOLDING PROGRAM)
- EXTEND 16-DIGIT ACCURACY TO TRS-80 FUNCTIONS (SUCH AS SQUARE ROOTS AND TRIGONOMETRIC FUNCTIONS)
- NEW DISK DRIVES FOR YOUR TRS-80
- PRINTER OPTIONS AVAILABLE FOR YOUR TRS-80
- A HORSE SELECTION SYSTEM***ARITHMETIC TEACHER
- COMPLETE MAILING LIST PROGRAMS (BOTH FOR DISK OR CASSETTE SEQUENTIAL AND RANDOM ACCESS)
- RANDOM SAMPLING***BAR GRAPH
- CHECKBOOK MAINTENANCE PROGRAM
- LEVEL II UPDATES***LEVEL II INDEX
- CREDIT CARD INFORMATION STORAGE FILE
- BEGINNER'S GUIDE TO MACHINE LANGUAGE AND ASSEMBLY LANGUAGE
- LINE RENUMBERING
- AND CASSETTE TIPS, PROGRAM HINTS, LATEST PRODUCTS COMING SOON (GENERAL LEDGER, ACCOUNTS PAYABLE AND RECEIVABLE, FORTRAN 80, FINANCIAL APPLICATIONS PACKAGE, PROGRAMS FOR HOMEOWNERS, MERGE TWO PROGRAMS, STATISTICAL AND MATHEMATICAL PROGRAMS (BOTH ELEMENTARY AND ADVANCED) AND

FREE WORD PROCESSING PROGRAM (Cassette or Disk)

For writing letters, text, mailing lists, etc., with each new subscriptions or renewal.



LEVEL II RAM TEST -

Checks random access memory to ensure that all memory locations are working properly.

SEND FOR OUR 36 PAGE SOFTWARE CATALOG (INCLUDING LISTINGS OF HUNDREDS OF TRS-80 PROGRAMS AVAILABLE ON CASSETTE AND DISKETTE). \$2.00 OR **FREE** WITH EACH SUBSCRIPTION OR SAMPLE ISSUE.

COMPUTRONICS

Box 149

New City, New York 10956

C114



24 HOUR
ORDER
LINE
(914) 425-1535



ONE YEAR SUBSCRIPTION \$24

TWO YEAR SUBSCRIPTION \$48

SAMPLE OF LATEST ISSUE \$ 4

START MY SUBSCRIPTION WITH ISSUE

(#1 - July 1978 • #7 - January 1979 • #12 - June 1979)

NEW SUBSCRIPTION _____ RENEWAL _____

CREDIT CARD NUMBER _____ EXP. DATE _____

SIGNATURE _____

NAME _____

ADDRESS _____

*** ADD \$6/YEAR (CANADA, MEXICO) - ADD \$12/YEAR AIR MAIL - OUTSIDE OF U.S.A., CANADA & MEXICO ***

Thoughts on the SWTP Computer System

Installment number 8 of this series looks at the new 6809 microprocessor.

Peter A. Stark
PO Box 209
Mt. Kisco NY 10549

The king is dead; long live the king!" So goes an old saying that may be apropos right now. "The 6800 is dead; long live the 6809!"

Motorola's 6800 isn't dead, of course, but SWTP's 6800 is. SWTP has apparently discontinued all manufacture and sale of their 6800 computer, and is concentrating completely on their new 6809-based system. I say "apparently" because it is

not entirely certain just how complete this move is. Will SWTP continue to support 6800 systems? Will they continue to sell bare boards or board kits? Will their disk systems continue in their present form, or will they, too, be revamped for the 6809? Only time will tell.

The only thing certain right now is that complete SWTP 6800 computers are no longer available. 6809 systems are available, but without — as yet — much supporting software.

As has been evident for some time, SWTP marketing strategy has changed over the past year or two. A 6809 kit will be

available (for \$495 with 8K of memory), but the initial push is for assembled systems, mostly with a lot of memory. SWTP (along with many other manufacturers) is aiming for the "business" market.

In a way, this may be a boon to SWTP competitors. Especially in the industrial market, 6800 demand will probably continue, and now that mainframes, cards, disk systems and all the other equipment are available from other manufacturers, that will be all that's sold. Unfortunately, none of these can offer the price/performance ratio that SWTP always has offered.

The Motorola 6809 Microprocessor

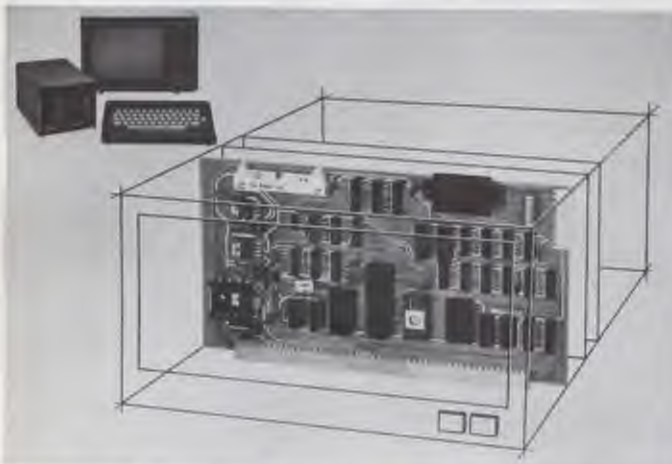
The 6809 is like a wolf in sheep's clothing. Internally, it is like a 16-bit processor; externally, it resembles an 8-bit processor such as the 6800. For this reason, it is hardware-compatible with older 6800 systems — so that with the addition of a new CPU board, older SWTP systems can use the 6809 — yet it can do software tricks not possible before.

It is a vast improvement over the 6800 in many ways, though not as compatible with it as generally thought. (It's not like the Z-80 being able to run 8080

programs. 6800 programs must be modified for new instructions; a few 6800 instructions that do not exist in the 6809 must be programmed around.)

The 6809 has two accumulators, but they can be used together as a 16-bit accumulator. It has two index registers and two stack pointers. It can perform 16-bit addition and subtraction and 8-bit multiplication. It can push and pull other registers, besides the accumulators, and has a variety of addressing modes that can greatly speed up and shorten programs. Some of the 6800's addressing modes are more versatile with the 6809 — direct addressing can be done throughout memory, not just in lower memory. Conditional branches can go anywhere, not just 128 bytes (more or less) forward or back.

Other addressing modes are new. For instance, there are indirect modes that allow handling data without loading the index register with a base address first. PC-relative addressing adds an offset or displacement to the address in the program counter, in much the same way as indexed addressing adds an offset to the contents of the index register. This allows writing completely relocatable programs without



The SBC/9 board for the 6809-based computer system. (Photo courtesy of Percom)

some of the tricks needed to do the same on the 6800.

In terms of hardware, the 6809 is available in two versions: the MC6809 with a built-in clock oscillator, which requires only an external clock to set clock speed, and the MC6809E with external clock inputs. The MC6809 with the built-in clock and a 4 MHz crystal operates at a 1 MHz clock speed to match older systems. An 8 MHz crystal (with the MC6809 version of the processor) operates at the higher 2 MHz clock speed; but this is not compatible with SWTP 16K and 32K memory boards and may not work with smaller boards either unless the memory chips are also replaced. (16K and 32K memory boards can apparently not be upgraded to work at the higher speed, due to the way the dynamic memory refreshing is done.)

SWTP also states in their 6809 CPU board instructions that the 6800 and 6809 mainframes may not work reliably above 1 MHz.

6809 pin signals are a bit different from those of the 6800. Bus control signals, designed for allowing other devices to share the bus with the processor, are different. Since the 6809 has a built-in clock oscillator, there is a clock output rather than clock inputs. The clock output is now called the E, or Enable, signal, instead of Q2. This better matches the E inputs that the PIA and ACIA chips have had for years. There is even a second clock output, now called the Q output. On the other hand, VMA (valid memory address) is now gone.

A third interrupt input, FIRQ (fast interrupt), has been added for really fast response. And an M.RDY (memory ready) input makes the processor wait for slow memory. (Shades of S-100 systems!)

When a program is rewritten to take advantage of the 6809's features, it can run a lot faster than on a 6800. But when it is just doctored up a little — by reassembling, for instance — then it runs somewhat faster, but not by much... not enough to justify the effort, anyway.



The new SWTP 6809 computer has a completely redesigned cabinet, and so looks like a completely new unit. Inside, though, there are some marked similarities.

SWTP 6809 System

The new SWTP 6809 computer has a completely redesigned cabinet, and so looks like a completely new unit. Inside, though, there are some marked similarities. There's still a motherboard with separate 50-pin connectors for CPU and memory and 30-pin connectors for I/O. There's still address decoding on the motherboard and a beefed-up power supply.

But there are some changes too. Some, such as the new I/O addressing on the motherboard, are minor. Others, such as the design of the CPU board and the monitor, are major. In fact, the CPU board — called the MP-09 (available for \$175 as a modification to present systems) — tells the whole story of the system.

In addition to the 6809, the MP-09 board has sockets for memory. But unlike the 6800 CPU boards, the MP-09 does not use an MC-6830 mask-programmed ROM monitor and does not have the 6810 128-byte scratchpad RAM of the earlier CPU boards. Instead, it has four sockets that are for single-supply 2716-compatible EPROM, ROM or RAM (like the MP-A2 CPU board). The new SWTP 6809 monitor is called SBUG-E and takes up 2K, or one socket. That leaves three more.

Those sockets can be used for 2716 2K x 8 EPROMs; they can also be used for other pin-compatible devices. SBUG-E comes on a mask-programmed ROM that fits those sockets;

other ROMs may be available later, or large users may be able to supply their own. Several manufacturers have also announced 2716-compatible RAMs, which are not yet available. Thus, the CPU board has room for up to 8K of memory in any combination of ROM, EPROM and RAM.

The four memory sockets are addressed as follows:

IC1—E000-E7FF
IC2—E800-EFFF
IC3—F000-F7FF
IC4—F800-FFFF (used for SBUG-E)

IC4, which is normally used for the monitor, is always enabled; the other three sockets have DIP switches that allow them to be either enabled or disabled and determine whether they are used for ROM or RAM (by controlling one of the pin connections).

But here's the rub. IC1 through IC3 are not usable with the SBUG-E monitor in a full-fledged 6809 system, because I/O in an expanded system will be moved up into the same memory region as these sockets occupy. The extra three sockets are intended for dedicated applications (industrial control, for instance), where a custom monitor — other than SBUG-E and one that would use other addresses for I/O — would be used. So these sockets (unlike the 2716 sockets on an MP-A2 6800 board) can generally not be used for extra software.

The addressing for these memory sockets is more

thorough than monitor addressing in older 6800 systems. Monitor and high memory addresses are fully decoded, so that extra addresses are not used up in vain. This was a big problem with the 6800 system, which dated back to days when memory was so expensive that nobody ever thought a hobbyist or small user could afford more than 32K.

The MP-09 board also has a 14411 baud rate generator; but whereas 6800 systems only generated baud rate signals for 110 through 9600 baud, the MP-09 can generate signals for as much as 38,400 baud. Since there are only five baud rate lines on the motherboard, a DIP switch and several jumpers are used on the CPU board to determine the exact baud rate signals that exit the CPU board to the bus. (Read on. In some cases, this baud rate generator may have to be disabled.)

Now to the differences. First of all, the MP-09 has improved facilities for releasing all buses during DMA transfers or in multiprocessor systems. This is in line with some of the 6809 features, which are designed for such advanced applications. This includes the familiar BA (bus available) line and some new signals. BS (bus status) replaces the old Q1 signal, and BUS REQ (bus request) can be strapped on the 110-baud line instead of the baud rate signal. These two signals are used to tell other boards (not yet developed) what the 6809 is doing.

Since existing boards need a VMA signal, but the 6809 doesn't provide it, the MP-09 manufactures a VMA whenever the 6809 indicates that the bus is being used and is not available for other use.

The MP-09 also connects some of the other new 6809 signals such as BS, clock (Q and E), M.RDY, BUS REQ and FIRQ to the 50-pin bus on the motherboard.

However, the SS-50 bus only started out with two extra unused lines, called UD (user defined) 1 and 2. Where did all the new signals go? Back in 1978, there were several



Pin no. (from left to right)	Old SS-50 signal	New SS-50C signal
1	1200 baud	1200 baud or S0
2	800 baud	600/4800 baud or S1
3	300 baud	300 baud or S2
4	150 baud	150/9600 or S3
5	110 baud	110 baud or BUS REQ
6	HALT	HALT
7	Q1	BS
8	BA	BA
9	RESET	RESET
10	R/W	R/W
11	VMA	VMA
12	Q2	E
13	UD1	Q
14	UD2	FIRQ
15	IRQ	IRQ
16	NMI	BUSY
17	M.RST	M.RDY
18		
19	+12 VOLTS	+16 VOLTS
20	-12 VOLTS	-16 VOLTS
21-23	+8 VOLTS	+8 VOLTS
24-26	GROUND	GROUND
27-42	A0 through A15	A0 through A15
43-50	D7 through D0	D7 through D0

Table 1. Old and new 50-pin buses.

Pin no. (from front to back)	Old SS-30 signal	New SS-30C signal
1	I/O PORT SELECT	I/O PORT SELECT
2	RESET	RESET
3	110 baud	110 baud
4	150 baud	150 or 9600 baud
5	300 baud	300 baud
6	600 baud	600 or 4800 baud
7	1200 baud	1200 baud
8-9	+8 VOLTS	+8 VOLTS
10	R/W	R/W
11	Q2	E
12-19	D7 through D0	D7 through D0
20	RS1	RS1
21	RS2	RS2
22	IRQ	IRQ
23	NMI	FIRQ
24		
25-26	GROUND	GROUND
27	+12 VOLTS	+16 VOLTS
28	-12 VOLTS	-16 VOLTS
29	UD4	RS3
30	UD3	RS2

Table 2. Old and new 30-pin buses.

meetings of 6800 manufacturers to hammer out what the standard SS-50 bus should be and what, if any, modifications should be made to it in the future. At that time, there was a consensus on three possible versions of the bus: SS-50A, SS-50B and SS-50C. SWTP is now using a slightly modified SS-50C bus in their 6809 system. Table 1 shows exactly what lines are used on the old and new bus. In the same way, Table 2 shows the changes to the 30-pin I/O bus.

We've already described some of the SS-50C changes. Let's now look at the others.

On the 50-pin bus, pins 16

and 17 were NMI and M.RST on the old bus. What happened to them? They are still on the MP-09 CPU board, but they are brought to connectors at the top of the board. M.RST (master reset) now must be wired through a short cable to the RESET switch on the front panel. Likewise, NMI must now be wired through a separate cable. In noisy environments, shielded cable may be needed.

The 12-volt supplies have been replaced with 16-volt supplies. As was described in the first installment of this series ("Some Thoughts on the SWTP Computer System," March 1979, p. 58), these supplies have

always been marginal, and changing from 12 volts to 16 should improve things. But watch out! Some add-on boards requiring 12 volts have, in the past, been designed without on-board regulators, relying on the 12-volt supplies' proximity to the required values. To use them in a new system, you will have to install the missing regulators, or risk serious damage to them.

The 50-pin bus also shows another change in pins 1 through 4; four of the baud rate signals can be replaced with signals S0 through S4, four additional address lines that allow the system to be expanded up to an advertised 384K of memory... and perhaps more.

MP-09 Addressing Circuitry

The big change, which affects the whole system and may make it impossible to switch back and forth between the 6800 CPU board and a new 6809 CPU board, is in addressing. The MP-09 CPU board, combined with the SBUG monitor, has an interesting combination of hardware and software for memory and I/O addressing.

The MP-09 board has sockets for two 74LS189 16 x 8 TTL RAMs: One of these (IC11), called the DAT (dynamic address translator), is required; the other (IC8) is optional, to be

used for extended addressing.

Dynamic Address Translator

The address translator is of immediate interest. It is basically a 16 x 4 RAM, which is addressed as locations FFF0 through FFFF. You may note that this overlaps the monitor, which is FC00-FFFF. But the difference is that the monitor is a read-only memory, whereas the RAM is write-only memory. The two do not conflict, even though they share the same address, since a read and a write can never occur at the same time. When a load is executed from FFFF, for instance, only the ROM is affected. When a store is executed to FFFF, only the RAM is affected. Since this RAM only stores four bits, only the rightmost four bits of the number being stored into FFFF-FFFF actually get stored in the DAT RAM.

Fig. 1 shows a simplified diagram of the DAT. The address inputs into the RAM are connected to the address bus through a 74157 selector, IC10. IC10 acts as a two-position switch, connecting either its four A inputs or its four B inputs to the RAM.

When the RAM is being written into, the selector is switched to the B inputs. The rightmost four bits of the address—shown as A3 through A0 at the bottom of the diagram—are fed through the selector to the RAM. Since

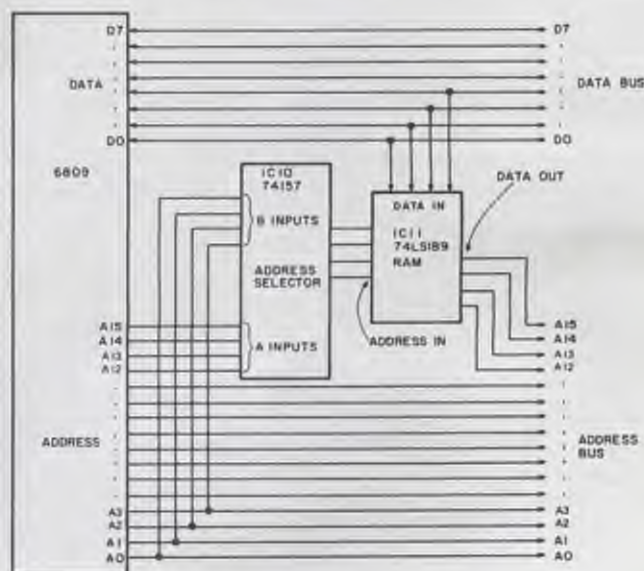


Fig. 1. Dynamic address translator.



The \$1 billion opportunity.

This January 15-18, over 9,000 British and European retailers, wholesalers, distributors and government purchasing agents will attend **TV-MEX 80**, the Microprocessor Electronics Show, in Birmingham, England.

They'll devour information on micro and home computers, electronic and microprocessor games, VCR's, telephones, video cameras and projection systems, digital consumer electronics and more. And for good reason.

Sales in the United Kingdom this year alone will top \$1 billion. And European sales will add hundreds of millions more.

A limited amount of display space is still available at **TV-MEX 80**. Join GEC Radio/TV, Decca, ITT, Texas Instruments, Microsensor Corp. (Apple), Prestel, BBC, ITA and more.

To reserve your booth, phone or write Technology Marketing Analysis Corporation (TMAC) today. And, if you hurry, take part in TMAC's VIP Tour. Enjoy discount airfare, first-class lodging, VIP cocktail party with key European buyers, tickets for three plays, rental car and more. (But please call now. The VIP Tour is limited to 50 people.)

Bring your company's story to **TV-MEX 80**. And let Europe's top consumer electronics showcase boost your bottom line.

To reserve your booth,
call toll-free:

**800-
227-3477**

in California (415) 474-3000

✓ T74

Technology Marketing Analysis Corp.
680 Beach Street, Suite 428
San Francisco, CA 94109



Gentlemen:

I wish to reserve display space at **TV-MEX 80**.

Please ☐ call with, or ☐ send more information.

I wish to join the VIP Tour (tax deductible under Section 274(h) IRS).

Please ☐ call with, or ☐ send more information.

Name

Title

Company

Address

City State Zip

Phone

the four bits represent the right-most hex digit in the address (FFFF through FFFF for the RAM), they determine where in that RAM data will be written. The data input itself comes from the lower four bits of the data bus.

Writing into the RAM in a simple 6809 system actually takes place fairly seldom — SBUG-E writes into the RAM once, just after it is started up. The rest of the time, the address selector is switched to the A inputs, and the RAM is more or less permanently placed into a read-only mode. But note that the data read (coming from the RAM's data out pins) doesn't go to the data bus; it goes to the address bus!

As you can see from Fig. 1, the top four bits of the 6809's address outputs, A15 through A12, don't go directly out to the address bus; instead, they go to the selector, and through it to the address inputs of the RAM. The top four bits of the address bus come out of the RAM's data outputs. So the top four bits of the address bus on the right need not necessarily be the same as the top four bits of what the 6809 is putting out.

There are two new words applied to addresses here. The address coming out of the 6809 — the address the program "thinks" is being called — is the *logical address*. The address that actually appears on the address bus and goes to memory and I/O is called the *physical address*. In 6800 systems, which have no DAT, the logical and physical addresses are always the same. Here they may be the same, but not necessarily. For instance, if every location of the IC11 RAM is programmed to hold a binary 0000, then regardless of what logical address the 6809 is outputting, the physical address will always start with a binary 0000.

On the other hand, if location 0000 of IC11 is programmed to 0000, location 0001 holds 0001, and so on, up to location 1111 holding 1111. Then the physical and the logical address will always be the same, because the data coming out of

the RAM will always be the same as the address going into it.

Since the DAT circuit works on the high-order four bits, it changes the leftmost hex digit of a 16-bit address into some other digit. For instance, it can change a logical 2 into a physical 3, so that every reference to locations 2000-2FFF will actually involve memory at 3000-3FFF instead. Since each 4K block of memory has a different first hex digit, the DAT circuit can move 4K blocks of memory around.

When a 6809 system using SBUG-E is first brought up, the monitor initializes the DAT RAM into a known memory pattern and then goes through memory, one 4K block at a time, testing each block to see if it actually has RAM there. In this way, it determines which physical addresses correspond to real RAM memory. Then, regardless of whether this RAM is in adjacent 4K blocks or not, the monitor readdresses these blocks, via the DAT RAM, to make them adjacent. Hence, regardless of how the RAM boards in a system are addressed, the DAT will readdress them where it wants them, as long as two boards don't have the same address.

But this is not the main purpose; the word "dynamic" in DAT is important too. This readdressing can take place dynamically, that is, as the system is running. SBUG-E doesn't seem involved here, but other system programs can change the DAT addressing too. This would occur, for instance, in time-sharing.

When two or more users are being time-shared on a computer, they each get a chunk of time, called a slice, during which their program runs. When the time is up for one user, his program is stopped and another's starts. This "context switch" can be done in several ways. The DAT can simply be reprogrammed so that the memory blocks assigned to user 1 are simply deleted from the DAT RAM, and the memory assigned to user 2 is relocated, via the DAT RAM,

to the same logical memory addresses previously held by user 1. If this is done at regular intervals — every 60th of a second, for instance — each user will get fast enough response that he will be unaware he is sharing time on the machine with someone else.

The context switching could, of course, be done in some other way too. For instance, all the memory assigned to user 1 could be written out to disk, and another user's program and data could be read in from the disk. This procedure would take much longer than leaving the material in memory but simply readdressing it somewhere out of the way.

Dynamic address translation such as this is of limited use if you're limited to somewhere between 32K and 64K of memory. The MP-09 CPU board has facilities for adding much more memory than that.

The Extended Address Bus

As mentioned earlier, there is room for another 74LS189 RAM; this one is optional. This RAM is IC8, which is wired up in a similar way to the DAT RAM in Fig. 1. The only differences are that the data into the RAM comes from the other four bits of the data bus (D5 through D7) and that the data outputs (S0-S3), instead of being part of the 16-bit address bus, become an extension of it. Counting these four bits, the extended address bus becomes 20 bits wide. With 20 bits, we could address 1,048,576 different memory locations for a total of 1024K, instead of just 64K.

Essentially, the lower 16 address lines address a 64K block of memory, while the four new address lines, S0 through S3, provide for 16 such blocks. Let's call each of these 64K blocks a page.

A change from one 64K page to another can be done simply by storing a new 4-bit page number into that optional RAM. But a program obviously can't flit back and forth between pages, since this would greatly slow everything down. Hence, going from one page to another is reserved for special occa-

sions, such as during complete context switches.

Actually, the system can't really be expanded to the full 1024K of memory. Some memory addresses are still needed for I/O, a monitor and perhaps other important programs such as a disk operating system, as well as their required RAMs. Hence, a certain amount of RAM, ROM and I/O will have to exist on every page and should ideally have the same addresses on every page. This eliminates a large area of each page from being used for normal processing, so that the total amount of memory is quite a bit less. SWTP expects the limitation to be 384K total, and their reasons are not yet entirely clear.

Note that making proper use of both the dynamic address translator as well as extended addressing up to 384K of memory requires two things: sophisticated software to keep track of what's going on and where and a need to do all this. There are a great many applications where the need for all this complexity in hardware and software is simply not there.

One hardware change must be made if the address bus is to be extended. As shown in Table 1, the four new address bits, S0 through S3, are sent along four lines on the 50-pin bus, which are normally used for baud rates. On the CPU board, this is accomplished simply by unplugging the MC14411 baud rate generator when the optional memory extension RAM is plugged in.

But since serial interface cards still need baud rates, these now have to come from somewhere else. SWTP is therefore offering a baud rate generator card, which plugs into the 30-pin I/O bus and provides those signals. A few cuts on the motherboard are required to isolate the baud rate lines on the 50-pin bus from those on the 30-pin bus.

The SBUG-E Monitor

SBUG-E is the new SWTP monitor ROM. It is a 2716-compatible 2K by 8 ROM, which resides on the MP-09

CPU board, addressed at F800-FFFF.

SBUG-E has two possible operating modes. As supplied, it permits up to 56K of memory to be installed on the main memory page. But this requires that I/O addresses be moved from the 8000 region, which they occupy in a standard 6800 system, up to E000. (It's not entirely obvious why this should be needed, considering that the DAT circuit should be able to move I/O at will. But one reason is that the monitor has no easy way of detecting, via programming, where the I/O is.) Hence a system will have to be modified to work with a standard SBUG-E; then it will not work with a 6800 CPU board.

However, by changing one byte in SBUG-E, you can retain I/O at address 8000, but then the memory is limited to just 40K total (32K and 8K, combined by the DAT circuit). This requires that SBUG-E be read into mem-

change to the motherboard.

2. At least 4K of RAM memory, physically addressed anywhere below DFFF.

Wherever that RAM is, SBUG-E will find it and relocate it, using the DAT, to logical address D000-DFFF. The region from D800 up to DFFF will then be used as the monitor scratchpad. (A disk system will need at least 8K just to boot the disk, and most applications would obviously need much more.)

SBUG-E can be thought of as divided into four areas: the user command processor, a set of user-callable subroutines, an interrupt and breakpoint handler and an initializer routine concerned with, among others, initializing the DAT and the various ports.

The user command processor is a greatly expanded version of what MIKBUG or SWTBUG had. Table 3 lists the commands from the keyboard that SBUG-E will respond to.

Control-A —	Alter the A accumulator
Control-B —	Alter the B accumulator
Control-C —	Alter the condition codes register
Control-D —	Alter direct page register
Control-P —	Alter program counter
Control-U —	Alter user stack pointer
Control-X —	Alter X index register
Control-Y —	Alter Y index register
B hhhh —	Set breakpoint at location hhhh
D —	Boot an SWTP 8-inch floppy system
U —	Boot an SWTP 5-inch floppy system
E ssss-eeee —	Examine memory from starting address ssss to ending address eeee
G —	Continue from a breakpoint
L —	Load tape
M hhhh —	Alter contents of memory location hhhh
P ssss-eeee —	Punch tape using specified addresses
Q ssss-eeee —	Test memory locations ssss through eeee
R —	Display register contents
S —	Display contents of stack
X —	Remove any existing breakpoints

Table 3. SBUG-E commands.

ory, that one byte be modified and a new monitor be burned into a 2716 EPROM. (Instructions are in the SBUG-E manual.) Even then, though, there are enough other small changes that the modified system will still not work with an old 6800 CPU board.

The standard SBUG-E requires a system configured like this:

1. An MP-S serial interface plugged into port 1 and I/O addressed at E000. This requires a

User-callable subroutines now use an address table at the very start of the monitor, locations F800 and up, to point to each subroutine. This allows monitors to be easily updated without having to go through contortions to keep all starting addresses the same as in previous versions. Standard subroutines such as INEE, OUTEE or PDATA exist (some with new names), as well as a few new ones: INCHECK checks if a character is waiting

Pascal/M T.M.

DIGITAL MARKETING announces CP/M* compatible Pascal. Pascal/M brings the language power of Pascal together with the extensive file handling capabilities of CP/M.

- Pascal/M allows the user to have full access to CP/M data files written in other languages (such as BASIC) and stored under CP/M.
- All CP/M utilities are available for managing Pascal Programs.
- All I/O is fully compatible with CP/M file structure.
- Built-in procedures provide for terminal-independent cursor controls.
- Standard Pascal/M is available for the 8080/85 or Z80 CPUs.
- A special Z80 version takes advantage of the Z80's extended instruction set.

This package includes diskette with P Code Compiler, Interpreter, and Runtime Library; Pascal User Manual and Report by Jensen and Wirth and Pascal/M User's Reference Manual. Pascal is available on 5 1/4" or 8" diskettes. The cost is \$350. For manuals only - \$35. • Visa/MC.

*CP/M is a trademark of Digital Research.

Digital Marketing

2670 CHERRY LANE
WALNUT CREEK, CA 94596
(415) 938-2880

✓ D63

FREE! software catalog for Apple® Owners

WE'RE SAVING ONE FOR YOU!

Here are a few highlights from our new catalog:

FILEMASTER 2 Programs: *FORMAT & RETRIEVAL* comprise a powerful Data File Manager. Great for everything from phone lists to legal abstracts. Design your own data structure. Up to 500 Char. per sec. Up to 15 searchable fields in any combo. Needs 32K Disk. . . . \$34.95

SPACE Multi-faceted simulation of life in interstellar society. You and opponents must make life & death decisions. Keeps track of your progress from one game to next. Six games in all. Needs 48K and Apple-soft ROM. . . . On Disk \$29.95

POT O' GOLD Our all new collection of 49 programs for 16K Apple. Everything from logic to action games. Only a buck a game. On Tape \$49. . . . On Disk \$54

ADVENTURE Fight off pirates and vicious dwarfs. 700 travel options, 140 locations, 64 objects. Needs Applesoft & 48K. . . . Disk \$29.95

APPLE MONITOR PEELED Everything you wanted to know about the Apple Monitor but couldn't figure out. User-written manual in plain English clears your confusion. . . . \$9.95
To order software, add \$2 shipping. Calif. residents add 6% sales tax. Or write today for your free catalog. VISA/Mastercharge welcome!



Garden Plaza Shopping Center, Dept. 1K
9719 Reseda Blvd., Northridge, Ca 91324 • (213) 349-5560

at the control interface; PCRLP prints a carriage-return and line-feed; LRA finds out what physical address a logical address corresponds to.

Finally, the interrupt and breakpoint handlers are written in a way that the interrupt system can more easily be used for user programs. There are three SWI instructions in the 6809, and each is provided a different interrupt vector address in RAM.

Modifications to Use MP-09/SBUG-E

In order to plug an MP-09 CPU board into an existing 6800 computer, you have to make a number of modifications. Let's describe them very briefly; they are covered more thoroughly in the MP-09 manual.

If 40K of memory is enough (32K in addresses 0000-7FFF and 8K somewhere else, but the DAT will make it appear continuous), then the I/O address decoding on the motherboard need not be changed, but SBUG-E will have to be modified and reprogrammed into a 2716. (This will obviously have to be done before the 6800 CPU board is unplugged.) The MF-68 mini-floppy is supported in this case, but the DMAF full-size floppy will not work like this.

To expand above 40K or to use the DMAF floppy, all I/O must be moved from 8000 up to E000. This requires that the motherboard have several traces cut and several new wires added. (This modification is much more complicated on the older MP-B board than the newer MP-B2 motherboard.)

In either case, the RESET switch from the front panel will have to be rewired from the motherboard; it connects directly to a connector at the top of the CPU board. Another motherboard change will involve the NMI and FIRQ connections, which are now different.

If a DMAF1 disk controller board is used, its addressing circuits will need to be changed so the disk can be addressed at F000-F3FF, instead of the 9000-93FF used in 6800 systems. But note: Once this is



Many think that SWTP has gone too far. Their system is versatile, but by taking such a gigantic step, they are placing a burden on those who want to convert existing systems.



done, you cannot plug your 6800 CPU board back in. It's not exactly an irreversible change — you can go back — but it's just as much work to go back as it is to switch to the MP-09 in the first place. Hence, before switching to the 6809, it would be a good idea to make sure that you have all your software ready: BASIC, assembler, editor, processor, disk operating system, disassembler, utilities. That's a tall order.

Alternative 6809 Approaches

Private conversations with many people involved in 6800 hardware and software indicate that many think SWTP has gone too far. Their system is versatile, but by taking such a gigantic step, they are placing a tremendous burden on those people who want to convert existing systems.

As an example of what I'm talking about, consider my own system. Since I have some nonstandard I/O equipment, such as a Selectric typewriter, I have a number of I/O subroutines in 2716 EPROMs on my MP-A2 CPU board. They are presently addressed from C000 through CFFF.

There are extra EPROM sockets on the MP-09 board, but as mentioned above, they cannot be used because their addresses conflict with system addresses. That's easy, you say. Either modify the CPU board to change the addresses or else install a separate EPROM board.

That raises some questions,

though. What will SBUG-E do with that EPROM? Will the dynamic address translator move its addresses to some other place in memory? Will that address be the same every time I power up the system? Will it be moved dynamically around with time? Or, worse yet, will the DAT simply ignore my EPROM and assign no addresses to it at all?

These questions apply equally to non-SWTP hardware. If you have an SSB or Percom disk, where will the EPROM be? If you have a parallel interface for a paper tape reader, or whatever, where will the DAT put it? It sure makes it difficult for SWTP competitors to offer any kind of hardware or software. Every customer's DAT might assign different addresses to it! For this reason, there are some other approaches.

The Percom 6809 Boards

Percom Data Company has two 6809 boards in the works: One is a simple adapter for plugging a 6809 into an existing 6800 CPU board; the other is a completely new 6809 board.

The 6809/6800 adapter board was described in the August 1979 issue of *68 Micro Journal* in an article by Byron Seastrunk. It contains a 6809, two ICs containing a few gates and inverters, a crystal and two resistors. The circuit, which was published in the *68 Micro* article, mounts on an MP-A2 CPU board and plugs into the socket that originally held the 6800.

The circuit could be built from the article or from a \$69.95 kit available from Percom. Either way, though, you need a 6809-based monitor. Percom is also offering their PSYMON on either a 2716 (\$69.95) or on a Percom diskette (\$29.95) for burning your own EPROM. Using it with an MP-A2 board is easy since the monitor can plug right into it. For use with an MP-A board, you'd need another EPROM board, plus a few cuts on the MP-A board to disconnect its own ROM socket.

Use of this adapter board still doesn't make it easy to switch back and forth between a 6800 and a 6809, but at least it does not require modifying the motherboard or memory boards. I suppose the best approach would be to wire up a separate MP-A2 board just for use with the 6809 adapter and then switch entire CPU boards. (Notice: You can't do that with the SWTP 6809 board because the motherboard and bus must be changed and are therefore no longer compatible.)

The other Percom board is a completely new 6809 CPU board. Percom's major aim was to have a CPU board that was completely compatible with existing hardware, yet had some new features of its own. It has enough jumpers so it can be configured either to use exactly the same bus as a 6800 system or to use a bus very much like the modified SS-50C bus used by SWTP.

PSYMON, Percom's monitor, lies at addresses FC00-FFFF. Right on the CPU board are a parallel port at F7FC-F7FF and a serial port whose ACIA is at F7FA-F7FB. Two 2114 RAMs on the CPU board provide 1K of RAM at F000-F3FF. All these addresses are fully decoded, so that other parts of this address range can be used for other purposes without interference.

Percom also is introducing a video board they call the Electric Window (EW). Their CPU board and monitor are set up to use the EW in the following way. When first powered up, PSYMON checks the video board's addresses to see if it is there. If the EW is connected,

then it configures itself to use the EW for output and the parallel port on the CPU board for keyboard input. The CPU board has 1K of RAM, so that the CPU/EW combinations can run programs all by itself.

If the EW is not connected, then PSYMON configures itself to use the serial port on the CPU board for I/O. There is a connector at the top of the board exactly like the one at the top of an MP-S serial interface card, so the terminal is just unplugged from the MP-S into the CPU board. The CPU board has baud rate generators, so, again, this one board can run programs.

Percom's CPU board does not have the dynamic address translator, since Gimix, SSB, Percom and other manufacturers offer devices, such as disk controllers, that need to know what addresses they are at. Since the SWTP monitor and DAT circuit put them where they want to, the DAT circuit on an SWTP CPU board would have to be disabled anyway to bring up the system. So Percom omits the DAT.

But there is provision for extended addressing. Normally, the CPU board's baud rate generator feeds its own ACIA as well as the baud rate lines on the bus. If no external serial interfaces are needed, then the baud rate lines and the buffer on the CPU board used to drive them will be used for extended addressing.

With just 32K of memory from 0000-7FFF, all the regular I/O can be left at 8000 (except for the terminal, which is now plugged into the CPU board). Otherwise, by modifying the motherboard, you can plug in up to 60K of memory if the I/O is moved up to the F000 region.

PSYMON comes in a 2708 EPROM and fits into one of two 2708 sockets on the CPU board; the other socket can be used for extended routines. But the two 2708 sockets can be jumpered to use either the Intel 5-volt 2716 or the TI TMS-2716, for a total of 4K of ROM. Normally, though, these sockets are addressed at F800-FFFF for 2708s, and the onboard 1K

RAM is at F000-F3FF. The Electric Window would be at E800.

PSYMON is quite a bit simpler than SWTP's SBUG-E. It occupies 1K at the very top of memory, but as soon as it initializes, it checks whether there is another ROM plugged into the other ROM socket. If so, it jumps to that ROM. Hence, PSYMON can be easily extended for more commands just by plugging in another IC.

PSYMON's Basic Command Functions

Memory examine is similar to MIKBUG's, but it saves the last address you looked at. It checks for bad memory, but only prints a question mark when it finds a location that won't write properly. This is done so that it is easier to change contents of I/O port registers.

Load and Save are also similar to MIKBUG, except that the load prompts for beginning and ending address instead of having to use addresses A002 through A005.

Up to ten breakpoints can be set into a program. They can be set and unset selectively or all at once. A command exists to print out the addresses of all outstanding breakpoints. When a breakpoint is encountered in a program, it is deleted.

Register dump and GOTO are similar to those of 6800 monitors.

Percom has a different philosophy on monitors and I/O. Their thought is that monitors should be simple, so they don't try to anticipate all the possible I/O and memory combinations users might hook up to the system. They did, however, try to make their I/O somewhat device-independent by having a small area of memory in RAM, called a DCB, or device control block, devoted to each I/O device. This DCB specifies the type of each serial or parallel device and where it is addressed. To change an I/O device, it's only necessary to change the DCB pointer in the scratchpad RAM. This allows echoing and I/O-to-I/O transfer by manipulating the DCBs.

GIVE YOUR TRS-80 WHAT IT DESERVES

All tapes \$10.00 each, on cassette.

C.O.D. orders accepted

Choose Level I or II.

A television station in Florida chose our *Bioforecast* program (catalog # CS-1) to use in a special news broadcast during the November 1978 statewide political elections. Many think ours is the best biorhythm program ever written. And it loads and executes in less than 4K!

One customer is using our *Orbit* programs (catalog # CS-2) to help him in the weather satellite work he does for the Air Force.

Recreation centers, schools, businesses, doctors, and housewives are using our *Lend Out* program. *Lend Out* (catalog # CS-7) keeps track of things loaned out to people. Its high utility, together with its many features and ease of use, have made it a best seller.

And speaking of best sellers

Our *Turkey Buzzard* game (catalog # GT-4) has made an even bigger splash than we expected. It is a game that has everything: a detailed scenario, character animation, and a general arcade style. It's chocked full of dangers and comic pitfalls. No wonder there are those who say it may be the most successful work ever to combine a continually changing plot with all TRS-80 graphics capabilities. Already it is becoming a classic among classics.

All of the above programs will execute in less than 4K RAM! You can't get those programs from any other company. We invented them and only we own the rights to them. Sure you can buy one of those cheap "software library" deals, but most of the programs they feature can be found in books. Books you can check out from your public library for nothing.

So for something truly different for your computer, look to the creative software company.

Send SASE to receive the product list faster.

6 Mill St. **Computrex** 
PO Box 536 Inman SC 29349

LET YOUR TRS-80 HELP YOU FIGHT THE HIGH COST OF LIVING!!

Inflation is robbing every consumer of the purchasing power of his dollar. There is no known way to completely stop this invisible bandit; but now, using your computer, you can minimize some of the bad effects on your household budget with the Computrex **HOME BREW PRODUCTS PROGRAM**! With the information this cassette software package provides, the average consumer can save as much as 50 to 90 percent on the price of common domestic products (from antiperspirant to window cleaner). This is because your microcomputer can tell you simple, easy ways to make these products from scratch in your home. Most products have low-cost ingredients which you can obtain at your local grocer, drugstore, or building supplier. The operation of this program is so obvious and straightforward, the documentation so complete and clear, that anyone can use this program effectively almost as soon as they receive it! No knowledge of computers is required.

Features:

- 1) Finds a product's formula or recipe by either the product's name or category use.
- 2) It's fast! No long waits for information.
- 3) When asked, the program gives a complete listing of all products for which it has formulas, and also displays their categories.
- 4) Special test feature which can check to see if the entire program loaded properly.
- 5) More!

The **HOME BREW PRODUCTS PROGRAM** is a Computrex exclusive. You can't get it from any other company. So show everyone that that computer of yours is more than just a game-playing toy. Order your copy of this unique software package today! Price: \$16.95 (requires 16K LEV-II)

See "NEW PRODUCTS" section of the November issue of this magazine. Also check back issues for ads describing some of our other fine products.

Note: We do not sell software through dealers and stores because our anti-plagiarism system will only work effectively with an exclusively mail-order market.

C.O.D. orders accepted. Phone # in our Oct ad is incorrect. Please use # in this ad to contact Computrex
Phone: 1-803-472-2083

Send S.A.S.E. to receive our product list faster.

6 Mill St. **Computrex**  C86
PO Box 536 Inman SC 29349

Percom is trying to make their CPU board versatile enough so that most SWTP and TSC software is likely to run on it. On the other hand, they also have to support their own disk systems, which require different disk drivers.

Their past approach in this respect has been to offer their own software (they have an excellent assembler and random BASIC, for instance), adapt other companies' software to run on their systems (Ed Smith's software is a good example), and as a last resort, simply provide at either low cost or no cost at all patches to other people's software to make it work on their disks (for instance, they have patches to Microware's cassette A/BASIC, Smoke Signal Broadcasting's Source Generator and TSC's Text Editor and Processor). It's a fairly safe bet that they will do the same for their 6809 CPU board.

The Gimix CPU Board

Another contender in the 6809 CPU board race is Gimix (1337 West 37th Place, Chicago IL 60609).

About a year ago, Gimix introduced their new 6800 mainframe. Compared with the cabinets SWTP users have gotten used to, this one is built like a tank. (Even the screw holes line up.) The power supply itself probably weighs more than the complete computer of "the other brand." Needless to say, the price is several times higher, but for industrial users this may not be significant.

About the middle of 1979, Gimix started to ship this mainframe with their new 6800/6809 motherboard. This board has some of the features that will be needed in 6809 systems of the future.

Aside from a variety of jumpers to give all sorts of options, Gimix puts the baud rate generator on the motherboard. This releases the five baud rate lines on the 50-pin bus, yet provides the required signals to I/O boards.

If you've noticed the RS2 and RS3 lines in Table 2, you may have wondered what they were.

6800 systems had a pair of lines called RS0 and RS1, which were actually two buffered lines from the address bus and were used by the I/O interfaces to give each I/O slot up to four addresses. For instance, you may remember that an MP-C control interface in port 1 had four addresses, 8004 through 8007, which were selected via the RS lines.

But there were some cases where four addresses per port were not enough. For instance, the SWTP MF-68 disk controller required a jumper in port 5, so that some of the addresses of port 5 were available to the disk

ones as well) can be used.

Now, to go with their new cabinet and motherboard, Gimix has designed a CPU board. Details are a bit sketchy at the time of writing, but it is obvious that Gimix is going another route. Instead of writing their own software to fit the board, they are designing the board to fit a major software undertaking that Motorola and Microware Systems Corp. are working on.

What About Software?

TSC has already announced their initial 6809 programs. At first glance, they appear to be

of your old 6800 software to the 6809.

Another 6809 product is a 6809 simulator that will run on a 6800; it's available from Micro Works.

Two products that I think will be essential are a 6809 assembler that will run on a 6800 and a 6800 disassembler that will run on a 6809. Nobody seems to be offering them, but for anyone who wants to convert his 6800 programs to a 6809, they would be very useful.

Perhaps the most ambitious 6809 software project is the one being developed jointly by Microware and Motorola. It is to be a fast and versatile BASIC, which Motorola intends to sell in ROM at a low price. (Gimix is waiting for it to appear before finalizing their CPU board. Wonder whether it will be compatible with the SWTP approach.)

The BASIC, which is called BASIC-09, is an incremental compiler; that is, each line is partially translated as it is entered. This also means that syntax errors are caught right away.

It is meant to be an expanded BASIC, which has all of the "standard" BASIC features, as well as some versatile extensions to make it more like PASCAL. In fact, Motorola hopes that it will become more popular than PASCAL. Much like PASCAL, it will have `IF... THEN... ELSE`; `WHILE... DO`; `REPEAT... UNTIL`-type statements. It's supposed to be procedure-oriented; that is, a program is divided up into more-or-less independent procedures, each of which handles a specific job. Each procedure can have variables that are strictly local and whose names can be reused elsewhere without conflict. Procedures are called by a name, along with some arguments for input or output from the procedure. Variable names can be any length.

It is also supposed to have user-defined data structures; for instance, a data structure can be thought of as a special-purpose array whose entries have different characteristics.



Everyone must make his own decisions on conversion to the 6809, but my own thought is that this is the time to sit back and wait for the dust to settle. Perhaps you shouldn't switch at all.



interface in port 6.

The new 6809 systems anticipate those problems by providing two more address lines to the I/O ports, so that each I/O port can have up to 16 addresses. The Gimix motherboard also has those lines; its I/O block is therefore 32 bytes long if only four addresses are used per port (four addresses times eight ports), 64 bytes if eight addresses are used or 128 bytes if 16 addresses are used. The decoding is thorough enough that these are all the addresses that I/O requires.

The Gimix motherboard also has an optional circuit that provides the appropriate Memory Ready (M.RDY) signal to slow down the CPU whenever an I/O operation is being done. The idea here is to give I/O a bit of extra time if a fast 2 MHz clock rate is used, so that older I/O boards (and probably slower

simply reassembled versions of their 6800 programs, with some updating to adjust such factors as timing loops. Their 6809 programs include:

6809 FLEX with Editor and Assembler. This requires memory at C000 and costs \$90.

The Text Editor (\$35) and the Assembler (\$40) are available separately in cassette form.

TSC BASIC at \$65 should turn in a stunning performance in the speed department. Unfortunately, with just six-digit math, it's a little limited for any kind of business application.

The 6809 Debug Package (\$75) for tracing and debugging programs.

TSC's advertising doesn't answer some important questions, such as whether their new FLEX will read text and binary files from disks written on a 6800 system. That's crucial if you're going to convert some

Outer Limits Addition

This handle on programming lets you smash some of the limits on programming.

```

10 REM LARGE NUMBER ADD PROGRAM BY JAY JOFFE
20 REM MODIFIED BY W3KBM
25 CLEAR
30 CLS
40 CLEAR 2000:REM ADDITION OF LARGE INTEGERS
50 DIM A(100)
60 DIM B(100)
70 DIM NS(100)
100 DIM T(100)
110 PRINT:PRINT
130 PRINT "THIS IS AN INTEGER PROGRAM..NO DECIMAL POINTS PLEASE"
140 PRINT "INSERT NUMBERS WHEN PROMPTED BY ?": GOTO 160
150 GOTO 140
160 GOSUB 340
170 GOSUB 400
180 PRINT "-----"
190 PRINT "A+B=":
200 GOSUB 560
210 GOSUB 630
220 FOR W = 2 TO 100: A(W)=0: B(W)=0: NEXT W: GOTO 25
230 GOTO 140
240 GOSUB 400
250 GOSUB 630
260 FOR X = (101-LEN(NS)) TO 100
270 T(X) = ASC(MID$(NS,X,1))-48
280 IF T(X) > 9 OR T(X) < 0 THEN GOTO 310
290 Y=Y+1
300 NEXT X:GOTO 330
310 PRINT "NON NUMERIC DATA"
320 FOR X = 1 TO 440:NEXT X: RUN
330 RETURN
340 Y=1: NS=""
350 INPUT "A=":NS
360 SIZE=LEN(NS)
370 GOSUB 260
380 GOSUB 780
390 RETURN
400 Y=1: NS=""
410 INPUT "B=":NS
420 SIZE = SIZE+LEN(NS)
430 FOR J=1 TO SIZE
440 JS=J$+"0":NEXT
450 NS=J$+NS
460 GOSUB 260
470 GOSUB 770
480 RETURN
490 FOR P = 100 TO 2 STEP -1
500 IF A(P)<10 THEN GOTO 540
510 C = INT (A(P)/10)
520 A(P-1)=A(P-1)+C
530 A(P)=A(P)-(10 *C)
540 NEXT P
550 RETURN
560 FOR R = 2 TO 100
570 A(R)=A(R) + B(R)
580 NEXT
590 GOSUB 490
600 RETURN
610 GOSUB 720
620 NS=""
630 GOSUB 790
640 GOSUB 720
650 NS=""
660 FOR X = T(1) TO 100
670 NS=NS+CHR$(A(X)+48)
680 NEXT X
690 PRINT NS: INPUT "PRESS ENTER TO CONTINUE":D$
710 RETURN
720 FOR X = 2 TO 100
730 IF T(X)=0 GOTO 750
740 T(1)=X: GOTO 760
750 NEXT X
760 RETURN
770 FOR X = 1 TO 100:B(X)=T(X):NEXT:RETURN
780 FOR X = 1 TO 100:A(X)=T(X):NEXT:RETURN
790 FOR X = 1 TO 100:T(X)=A(X):NEXT:RETURN
800 END

```

Program listing.

Once you get past certain items, such as breathing, eating and sleeping, it becomes a bit sticky to define what else may be of Universal importance. For instance, as the owner of a brand new TRS-80 Level II, you may not care that you cannot get last-digit accuracy with the following addition problem: 99-9999999888888888 + 2. 1E+18 is what will be displayed on your monitor. You can tell by inspection that the accuracy to the last digit will show the real-life answer to be 999999999888-888890. Certainly, you will not let "hitting a limit" cause you to send your TRS-80 back to its mother with a note asking, "What gives?" It is all too true that for practical folk the difference in the two answers is not going to mean much.

However, for you fans of the infinite, you folk of all persuasions that aspire to be programmers, limits are annoying. They represent a chance to extend the capabilities of your machine into the outer limits and at the same time exercise your skills at what it is really all about, in other words, programming.

The Program

By now you must be fairly sure that there is a way to turn your TRS-80 into a nitpicking, last ditch, last digit, adding fool. The Program listing here provides one answer to the problem.

The largest portion of this program was produced by my son, Jay, in response to my initial frustration with the basic premise of it all: "Why can't I get this machine to do what I think it should do rather than what I think I told it to do?"

Examining the listing, be aware that it is an integer pro-

gram only. If you try to slip in a decimal point, one of the nicely nested subroutines will print the message listed in line 310, "Non Numeric Data," and send you back to the start. It will do the same thing if your wandering fingers should strike a letter on your keyboard. The program, fundamentally, puts the two numbers to be added into aligned arrays and then proceeds to add them and print out an answer.

If you examine the listing closely, you will see a variable called SIZE, which first appears in line 360. This line with its companion lines inserts leading zeros into the appropriate array cells that may or may not be filled with pertinent numerical information. If you calculate a sum with pencil and paper, you do the same thing by carefully aligning the numbers one under the other so you can properly add them. You do not write in the leading zeros, but your method is the same. You can mentally ignore these gaps, but if the computer is to function properly it must fill in those gaps, since it has no imagination to help it while it adds.

Consider line 340 in the program—Y=1: NS="". The "" may possibly be unfamiliar and lead to problems when you key the program into your machine. This symbol is composed of two quote marks with no separation as typed, and essentially it provides a NULL, which resets the value of NS back to zero.

Jay tends to lean toward a type of structured programming that may initially be hard to follow due to the liberal use of nested subroutines. You may knock this approach, but it does work well. ■

15 ISSUES FOR \$15!

☐ YES . . . enter my subscription for 12 months of Kilobaud Microcomputing for \$15 (a \$15 saving off the newsstand price) and send me three more great issues **FREE!!!!**

Please send me the following issues:

#1 _____ #2 _____ #3 _____
(please print month & year)

My alternate choices are:

#1 _____ #2 _____ #3 _____
(please print month & year)

Important: indicate subscription status.

☐ New Subscription ☐ Renewal ☐ Payment enclosed
Bill my: ☐ VISA ☐ Master Charge

Card # _____ Exp. date _____

Signature _____

Name _____

Address _____

City _____ State _____ Zip _____

Canadian subscriptions add \$2 a year. All other foreign subscriptions \$23 one year only, payable in U.S. funds. Please allow 4-6 weeks for delivery of first copy.

Kilobaud Microcomputing/Subscription Services Dept. • P.O. Box 997 • Farmingdale NY 11737

501J22

15 ISSUES FOR \$15!

☐ YES . . . enter my subscription for 12 months of Kilobaud Microcomputing for \$15 (a \$15 saving off the newsstand price) and send me three more great issues **FREE!!!!**

Please send me the following issues:

#1 _____ #2 _____ #3 _____
(please print month & year)

My alternate choices are:

#1 _____ #2 _____ #3 _____
(please print month & year)

Important: indicate subscription status.

☐ New Subscription ☐ Renewal ☐ Payment enclosed
Bill my: ☐ VISA ☐ Master Charge

Card # _____ Exp. date _____

Signature _____

Name _____

Address _____

City _____ State _____ Zip _____

Canadian subscriptions add \$2 a year. All other foreign subscriptions \$23 one year only, payable in U.S. funds. Please allow 4-6 weeks for delivery of first copy.

Kilobaud Microcomputing/Subscription Services Dept. • P.O. Box 997 • Farmingdale NY 11737

501J22



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud

MICROCOMPUTING T.M.

**Subscription Department • Box 997
Farmingdale NY 11737**



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud

MICROCOMPUTING T.M.

**Subscription Department • Box 997
Farmingdale NY 11737**



15 ISSUES FOR \$15 KILOBAUD MICROCOMPUTING SUPER OFFER!

If you've been thinking about subscribing to Kilobaud Microcomputing, this is the time to do it. Subscribe today at the special discount price of \$15 (save \$15 off the newsstand cost for one year) and receive your choice of 3 back issues from the following pages FREE! If you already subscribe to Kilobaud Microcomputing, you know what a fine magazine it is, and you'll want to renew now . . . and receive your 3 free issues too!

Look over the wealth of information included in these issues. By subscribing now, you can choose 3 free issues and start your encyclopedia of Microcomputing right away. Simply indicate on the attached postage-paid card the issues you wish to receive. Please indicate 3 alternate choices as these issues are going fast. Allow 4 to 6 weeks for delivery. (Your subscription will begin with the next published issue.)



January 1977

- ☐ Is the Z80 the Wave of the Present?
- ☐ Tiny BASIC
- ☐ How a Memory Works
- ☐ Software Exchange
- ☐ Practical Microcomputer Programming: Part 1: Logical Instructions
- ☐ Well, Your Micro's Built: where do you grow from here?
- ☐ Computer Control of the World: turning ac powered devices on and off with your computer
- ☐ Wire Wrapping
- ☐ The Hobbyist's Operating System: Part 1: Introduction and Master Plan
- ☐ Solving Some of the Software Interchange Problems
- ☐ Welcome to Assembly Language Programming
- ☐ Programming? It's Simple!
- ☐ Structured Programming
- ☐ Computers in Golf: help for the handicapped
- ☐ Computer Widow
- ☐ What's that Digital Group Really Doing?
- ☐ How to Use the New PR-40 Printer
- ☐ Fire! let your micro call for help
- ☐ A Teletype Alternative
- ☐ Nobody Knows the Troubles I've Seen
- ☐ Structured BASIC: A negative view by Dr. Kemens, the author of BASIC
- ☐ Six Games on a Chip

February 1977

- ☐ ZAP!
- ☐ Chasing Those Naughty Bits
- ☐ Why So Many Computer Languages?
- ☐ The Remarkable Apple Computer
- ☐ Beware the Wumpus
- ☐ Chase!
- ☐ Will the Z-80 Crush All Competitors?
- ☐ Practical Microcomputer Programming: Part 2: Operating Systems
- ☐ The Trouble with Mass Storage Systems
- ☐ A Useful Loan Payment Program
- ☐ Submarine! a game for the SR-52
- ☐ The Hobbyist's Operating System: Part 2: Interfacing with the Monitor
- ☐ Found, A Use for Your Computer! a clock program for the KIM
- ☐ Sophisticating a Surplus Keyboard
- ☐ At the Races
- ☐ RCA Tries Again: with the 1802
- ☐ 8080 vs. 370
- ☐ Cut 6800 Programming Time with this Extraordinary Program
- ☐ 7 x 9 = 56
- ☐ Learning Computerese
- ☐ How to WIN the Surplus Game
- ☐ Making Money Is Nice
- ☐ The 8080 You May Have Missed
- ☐ The "Kill a Byte" Standard
- ☐ A 6800 Single Stepper
- ☐ Computerized Statements

March 1977

- ☐ Practical Microcomputer Programming: Part 3: Software Tools
- ☐ The Motorola Way! review of the MEK6800D1
- ☐ Let's Hear It for the 6800!

- ☐ The Paper Tape Caper
- ☐ Computers for Free!
- ☐ A New Approach to the 6800: the Astral 2000
- ☐ Journey into the CPU
- ☐ Only Five Senses
- ☐ Floppy Disks
- ☐ The Jupiter II
- ☐ How to Win \$25,000 of Your Own Money
- ☐ Using the "550" Terminal
- ☐ External Mass Storage: Part 2: Digital and Audio Cassette Systems
- ☐ Make Your 6800 Smarter: a cheap memory expander
- ☐ Stop Bug! Now!
- ☐ Clocked Logic: Part 1: The D Type and JK Flip-Flops
- ☐ The Gory Details of Cassette Storage
- ☐ The Fun of Learning BASIC
- ☐ Super-Tube: jazzing up the Digital Group TVT

April 1977

- ☐ Interrupts Exposed: using microprocessor interrupt capability effectively
- ☐ Clocked Logic: Part 2: Some Basic Applications
- ☐ Build an Eight Channel Multiplexer for Your Scope
- ☐ Sorting Routines
- ☐ Number Rounding Program
- ☐ Meet the Tarbell/KC Interface
- ☐ Super-Tester: a digital design aid
- ☐ The Hobbyist's Operating System: Part 3: Command Language Processing
- ☐ The Slow-Stepping Debugger
- ☐ BASIC—The Easy Way
- ☐ Now You Can Use Software Timing Inputs
- ☐ KIM-1 Memory Expansion
- ☐ Heavy Duty Power Supply
- ☐ Digital Audio
- ☐ HI-LO
- ☐ Interfacing the Analog World
- ☐ Everything about Semiconductor Memory
- ☐ Three-State Logic: explanation of a key microprocessor element
- ☐ Automatt: Memory Dumper: utility dump program for 6800 users
- ☐ Hangmath! a new puzzle game
- ☐ Now = BASIC for the 8008—Even!
- ☐ Microprogramming: an insight into microprocessor design
- ☐ Computerized Babysitters

May 1977

- ☐ Clocked Logic: Part 3: Data Converters and Special Functions
- ☐ Cure Those End-of-Month Blues: with a sales analysis program
- ☐ Make Your Investment Count: the inside view of a custom MP-68
- ☐ Speed Up Your 6800
- ☐ Who's Afraid of RS-232: data communications explained!
- ☐ Is it High—or Low? understanding logic design conventions
- ☐ Know Thieve! confessions of a kit-builder
- ☐ Prototyping Systems Exposed! a revealing look at the Intercept Jr
- ☐ Interrupts Exposed: Part 2: Implementing an Interrupt-driven System
- ☐ Digital Audio: Part 2: Generating that Weird Music
- ☐ Now It's Insci BASIC!

- ☐ Bridging the Gap: tips on turning an application into a program
- ☐ Adding "Plop" to Your System: a noisemaker for computer games
- ☐ Lunar Lander
- ☐ Silence Noisy Teletype Motors: Part 1: Getting the Ball Rolling
- ☐ A Home Computer Pioneer: profile of Don Tarbell

June 1977

- ☐ Build Your Own Interface
- ☐ Computer Club Promotional Techniques
- ☐ Artillery Practice
- ☐ Put a Micro in Your School
- ☐ Turpitudes Away!
- ☐ Build a Pulse Generator
- ☐ A TVT for Your KIM
- ☐ The BYTDESTROYER: review of an EPROM eraser
- ☐ BASIC Timing Comparisons
- ☐ Solving Keyboard Interface Problems
- ☐ A Clean Cassette
- ☐ Try a Design Console: for practical hardware prototyping
- ☐ Try Solar Energy
- ☐ Simplified Billing System: in BASIC for the small business
- ☐ Kilobaud Klassroom: No. 2: Gates and Flip-Flops Explained
- ☐ Computerized Typesetting: an introduction to word processing
- ☐ Introducing! The World's Cheapest Computer: a \$60 SCMP
- ☐ My Friend is a Computer Junkie

July 1977

- ☐ Inside the Sphere Microcontroller
- ☐ The Great TV to CRT Monitor Conversion
- ☐ Computer Turns Director: an interview with filmmaker John Whitney
- ☐ The Random Number Game
- ☐ Cassette Interface First Aid: use your processor to set timing
- ☐ Understand Your Computer's Language
- ☐ Kilobaud Klassroom: No. 3: JK Flip-Flops and Clock Logic
- ☐ Digital Audio: Part 3: Signal Expansion and Compression
- ☐ It Was Great! reviewing The First West Coast Computer Faire
- ☐ Pass the Buck: computer decision-maker program
- ☐ Inside the Amazing ASR 33: checking out the most popular terminal
- ☐ Try Computer Composition

August 1977

- ☐ Cassette I/O Format
- ☐ Expand Your SWTP 6800: with a new 8K board
- ☐ Trigger Your Oscilloscope
- ☐ Sobriety Tester Program
- ☐ Random Integer Program
- ☐ Test ICs With Your Micro
- ☐ Heavy Duty Altair Power Supply
- ☐ Is the KIM-1 For Every?
- ☐ Electronic Design by Computer
- ☐ Understand Your Computer's Language: Part 2: Instruction Sets

kilobaud microcomputing

15 ISSUES FOR \$15: A SUPER OFFER

August 1977, continued:

- ☐ Enter the Audible Computer!
- ☐ Time Bomb Game
- ☐ Try a Do-All Program!
- ☐ Sooo, You Want to be an Author!
- ☐ SWTP 4K BASIC Notes... implementing it on the 6800
- ☐ Hexdec... hexadecimal to decimal conversion
- ☐ Start a One-Man Computer Club
- ☐ Troubleshoot Your Software... a trace program for the 6502
- ☐ Cure that Hot Power Supply

September 1977

- ☐ Build Your Own ASCII Keyboard... with serial and parallel output
- ☐ The Ultimate Personal Computer
- ☐ Talk Your Computer's Language!
- ☐ A PET For Every Home... a look at the Commodore PET 2001
- ☐ Kilobaud Klassroom... No. 4: PC boards and power supplies
- ☐ Seals Electronics
- ☐ Try an 8080 Simulator
- ☐ Build a \$20 EPROM Programmer... for the 5402 4K chip
- ☐ Faster MIBUG Load Technique... uses binary format
- ☐ Decoding Device Control Codes... uses a UART, naturally
- ☐ Tarbell Asynchronous Format
- ☐ Baseball in BASIC
- ☐ Using an Invisible PROM... how to relocate monitor programs
- ☐ Klingon Capture Game
- ☐ Starting a Business!

October 1977

- ☐ BASIC Timing Comparisons
- ☐ Learn and Earn... BASIC and business programming
- ☐ Bargain Time!
- ☐ Hello! Today's Program Is... understanding computer speech recognition
- ☐ Beware the Altair Bus
- ☐ Put Your Insai on the Rack!
- ☐ 3D Computer Graphics
- ☐ Memory Troubleshooting Techniques
- ☐ Understand Your Interrupts!... real time clock applications
- ☐ Kilobaud Klassroom... No. 5: hardware logical functions
- ☐ Digital Group MAXI-Basic
- ☐ Utilize ASCII Control Codes!
- ☐ Dedicated Controllers
- ☐ Try WORDMATH!
- ☐ Time for Timesharing!
- ☐ Build a Universal I/O Board... for your Altair

November 1977

- ☐ Everything about Assemblers!... sure beats hand-coding
- ☐ Your Image Counts!
- ☐ Lifetime Program
- ☐ Consider a MITE Printer... alternative to the ASR-33
- ☐ Tired of Substituting Chips?
- ☐ Stretch Those Characters... mods for the SWTP PR-40
- ☐ Magnetic Bubble Memory
- ☐ Reliable Conversion Techniques
- ☐ Salesmanship, Hardware and Coffee
- ☐ Hyper about Slow Load Times?... KIM Hypertape is an alternative
- ☐ Interested in Commercial Programming?
- ☐ Kilobaud Klassroom... No. 6: voltage, current and power supplies
- ☐ Expand Your KIM!... with Altair bus devices
- ☐ Enhance Your Memory... with home information retrieval
- ☐ Build the \$35 Modem... uses the MC14412 and a UART
- ☐ Another Look at Benchmark Program
- ☐ Son of Submarine Game
- ☐ Payroll Program... for small businessmen
- ☐ SCIMP Goes Baudot... add an inexpensive TTY

December 1977

- ☐ TVT Hardware Design... Part 1: instruction decoder and scan
- ☐ Expand Your KIM!... Part 2: getting to the nuts and bolts
- ☐ Payroll Program (Continued)... cassette techniques
- ☐ The Business Market
- ☐ ALL CAPS
- ☐ The "Learning Machine"... math tutor program
- ☐ Kilobaud Klassroom... No. 7: transistors, diodes and op amps
- ☐ Complete Guide to Logic Diagrams
- ☐ Tiny BASIC
- ☐ The Twelve Days of Christmas
- ☐ Paper Tape: It's Here to Stay... a look at the OP-80A
- ☐ Tempus Fugit
- ☐ Who Needs a Broker?
- ☐ Here's HUEY!... super calculator for the 6502

- ☐ Crash Landing!... a real-time Lunar Lander game
- ☐ File Structures Simplified

January 1978*

February 1978

- ☐ Blorhythms with Your KIM
- ☐ Vandenberg Data Products 16K Board Reviewed
- ☐ Inventory, Accounts and Reports
- ☐ Small Business Software... Part 1: accounts receivable
- ☐ The Music Man
- ☐ STAR WARS
- ☐ Hot-Rod Mods for Your SWTP System
- ☐ Tickled by Fickled... a charting and diagramming aid
- ☐ Ready on the Firing Line!
- ☐ Expand Your KIM!... Part 3: bus control board and memory
- ☐ Interfacing Tips
- ☐ Kilobaud Klassroom... No. 9: Counters and Registers
- ☐ Teaching Preschoolers Letter Discrimination
- ☐ Why Structured Programming?
- ☐ Source Listing the Hard Way
- ☐ How Good Is Tarbell's Floppy Interface?
- ☐ Manipulating ASCII Data
- ☐ Read any Good Books Lately?... a program to test readability
- ☐ George Morrow's Versatile Front-Panel Board
- ☐ Deflection!... a video game for the quick and agile
- ☐ How Much Memory for a KIM!

March 1978

- ☐ Build the "Simple Computer"... a home-brew 8080
- ☐ Hardware Program Relocation, Part 2
- ☐ State Capitals
- ☐ Customized MIBUG
- ☐ TV Typewriter Update
- ☐ Foolproof Cassette Operation
- ☐ Number-Crunching Time
- ☐ Super Terminal!... interfacing the Burroughs 9350-2
- ☐ Consumer Computer, Inc.
- ☐ Programmed Instruction Made Easy: Tiny PILOT, Part 1
- ☐ Protect Your Memory Against Power Failure
- ☐ Backup Techniques... how fail-safe is your system?
- ☐ Small Business Software, Part 2
- ☐ Expand Your KIM!... Part 4: a TTY substitute
- ☐ Faster Erase Times... build a quicker EPROM eraser
- ☐ I/O Programming for the Altair Disks
- ☐ The Axiom EX-800
- ☐ Tiger Trouble!... TI programmable-calculator safari
- ☐ Temperature Sensing
- ☐ A Different Approach to HI-LO

April 1978

- ☐ Kilobaud's Mystery Program
- ☐ Make Your Own PC Boards
- ☐ CPIM Primer
- ☐ Space-Saver System... the TI 59 and PC-100A
- ☐ How to Make Your SWTP System Happy
- ☐ The Coming Tragedy: Poorly Designed Small-Business Systems
- ☐ Useful Programs for Your 6800
- ☐ Memory Debugging
- ☐ 3-D Tic-Tac-Toe
- ☐ Programmed Instruction Made Easy: Tiny PILOT, Part 2
- ☐ Blue Is the Color... Solid State Music is the company
- ☐ Cash Register: A Practical Math Simulation
- ☐ Parsing Techniques for the 6800
- ☐ Incrédizing... amazing, incredible game for 8080 systems!
- ☐ Avoid Program Loading and Reloading
- ☐ Time-sharing for the Home System
- ☐ Displaying Hexadecimal
- ☐ Build a Touch-Response Display
- ☐ Power-Down Mod for the TRS-80
- ☐ Finally: 8080 Meets the Fairchild Video Game
- ☐ Get a Watchdog... to monitor those real-time operations

May 1978*

June 1978

- ☐ Taming the I/O Selectric... Part 1: hardware interface
- ☐ Home-Brew Z-80 System... Part 1: front-panel construction
- ☐ A Strategy for Healthy Living... computerized exercise/fitness program
- ☐ A Tour of the Faire, Part 1
- ☐ Tiny BASIC Shortcuts
- ☐ Baudot... er... Murray, Meet the H8
- ☐ 8080, Z-80 or 8085
- ☐ One Keyboard: Hex and ASCII
- ☐ Is the Malibu Model 160 the Printer for Your Business System?
- ☐ The Great Computer Conspiracy

*issues not available.

- ☐ Personal Computer Shows
- ☐ Cross-Country Balloon Trip
- ☐ Transfer Vectors vs Absolute Addressing
- ☐ Error Correcting Codes
- ☐ ASCII to Baudot... er... Murray (the Hard Way)
- ☐ Bowling Scores for Dollars
- ☐ Machine Language for the TRS-80... Radio Shack's T-BUG
- ☐ Two Systems Sharing the Same Bus
- ☐ Computers in Classrooms: Teaching the Teachers

July 1978*

August 1978

- ☐ DOCUFORM: A Word-Processing System for Everyone!
- ☐ Kilobaud Klassroom... No. 11: Data and Address Buses
- ☐ Software Debugging for Beginners
- ☐ Mits vs North Star
- ☐ Kansas City Standard... at 1200 baud
- ☐ Swords and Sorcery!
- ☐ Two Hobbies: Model Railroad and Computing, Part 2
- ☐ Update: Lunar Lander
- ☐ The Do-It-Yourself System... Heath's H8 is a winner!
- ☐ KIM + Chess = Microchess
- ☐ Is There Intelligent Life in Your Computer Room?
- ☐ From Base to Base... with your HP 25
- ☐ FINANC: A Home/Small-Business Financial Package
- ☐ Computer-Generated Signs
- ☐ Copying Computer Cassettes
- ☐ Something Extra With Radio Shack's BASIC
- ☐ The Amazing 1802
- ☐ Who Needs a UART?
- ☐ Can't Find It?... an index for your SWTP BASIC manual

September 1978

- ☐ (Con)text Editor
- ☐ At Last: A Client Timekeeping System
- ☐ Troubleshooters' Guide
- ☐ Metric-American Conversion Program
- ☐ The Heath/DEC Connection... Part 1: overview
- ☐ Home System Demo Program
- ☐ Do-It-All Expansion Board for KIM
- ☐ Tally Ho!... fox and hounds game
- ☐ Baudot Interface Cookbook
- ☐ Error-Correcting Techniques
- ☐ KIM Organ
- ☐ Kilobaud Klassroom... No. 12: ROM and RAM memories
- ☐ Motorola's Latest: The MC6802
- ☐ TRS-80 Update: Level II BASIC
- ☐ Super Cheap 2708 Programmer
- ☐ Something Extra in Mass Storage... Meca's Alpha-1
- ☐ From Big BASIC to Tiny BASIC

October 1978

- ☐ Budget System... KIM, keyboard, TV, TVT-6L and AKIM
- ☐ The Heath/DEC Connection... Part 2: H11 system peripherals
- ☐ Depreciation Calculations
- ☐ Looping in Tiny BASIC
- ☐ Kilobaud Klassroom... No. 13: I/O Circuitry
- ☐ Let Your Computer Wear a Watch
- ☐ Randomness is Wonderful
- ☐ Dazzler and BASIC
- ☐ The Latest in Operating Systems for the 6800: FLEX
- ☐ Action on the Enterprise
- ☐ Will DEC and IBM Be the Final Winners?
- ☐ Little Bits
- ☐ View from the Far East
- ☐ Use That Parity Line!
- ☐ The Software Patchcord
- ☐ A Useful Address List Program
- ☐ Ready for the Nuthouse!

November 1978*

December 1978*

January 1979

- ☐ An Editor for 6800 BASIC Programs
- ☐ u-Panel for KIM
- ☐ Rolling Dice
- ☐ Pseudo Graphics
- ☐ The BCS and Its President
- ☐ Address List Editor
- ☐ Display Your PET!
- ☐ TRS-80 Tape Controller
- ☐ SHHH—People Are Sleeping
- ☐ Say It with a Banner
- ☐ Open House
- ☐ Cassette Interfacing
- ☐ PET Techniques Explained
- ☐ A Service Bureau for Hobbyists
- ☐ Little Bits
- ☐ Keeping Ma Bell Happy

kilobaud microcomputing

ARTICLES YOU MAY HAVE MISSED

February 1979

- ☐ Block-Structured Language for Microcomputers
- ☐ Kilobaud Classroom, No. 16: I/O IV
- ☐ Computerized Climate Control
- ☐ Music, Maestro!
- ☐ Madam Dupe's House of the Zodiac
- ☐ Disk Power!
- ☐ Inventory Control with the TRS-80
- ☐ Onward with the COSMAC III!
- ☐ Build a \$50 TVT!
- ☐ Percom's LFD-400 Floppy Disk System
- ☐ DOTS
- ☐ The Apple Speaks—Softly
- ☐ Super Mastermind
- ☐ TRS-80 Level II Reference Manual Index
- ☐ Care and Feeding of Cassette Tapes (Part 2)
- ☐ Text/Document Preparation Made Easy
- ☐ Simpler Interest
- ☐ Learn BASIC—with BASIC
- ☐ Use Flowcharts to Communicate
- ☐ Joystick Interface for Your Altair
- ☐ Attack on the Pack!

March 1979

- ☐ Cheap Video for Your Heathkit H8
- ☐ Analog and Digital Interfaces
- ☐ The "El Cheapo" EPROM Programmer
- ☐ Is Your Video Monitor Dangerous?
- ☐ Thoughts on the SWTP Computer System
- ☐ PET User Port Cookbook
- ☐ Chess Pawn
- ☐ Home Computer Exterior Ballistics
- ☐ Heath H9 Page Erase
- ☐ The SKIP II Microcomputer
- ☐ Ultra Banner
- ☐ Teletype's KSR-43
- ☐ The One Percent Forecasting Method
- ☐ Too Many Variables?
- ☐ Kilobaud Classroom No. 17: I/O V
- ☐ The Electric Pencil
- ☐ How to Talk to Your 8080
- ☐ Programming the 1802
- ☐ Keyboard Interrupt for the TRS-80
- ☐ The OSI Model 500
- ☐ Sleep Better with a Microcomputer
- ☐ Telpar Thermal Printer

April 1979

- ☐ A Look at TRS-80 Peripherals
- ☐ Heath H8 Disk System
- ☐ DOTS (Part 2)
- ☐ Truly Random Numbers
- ☐ SWTP CT-1024 Mod
- ☐ Who Sells Software?
- ☐ How Important Is Proper Termination?
- ☐ How to Talk to Your 8080 (Part 2)
- ☐ Parallel Port to RS-232—Inexpensively
- ☐ Free Speech Lessons for the TRS-80
- ☐ Let's Go Flying
- ☐ Floppy Disk System from Tarbell
- ☐ The Wait State Explained
- ☐ Depreciation Analysis
- ☐ Twin Cassettes for Your TRS-80
- ☐ Bar-Graph Generator
- ☐ Let's Have Some Order
- ☐ Quicksort!
- ☐ Put Something Super in Your Life
- ☐ Starship Attack
- ☐ Terminate Your Troubles
- ☐ Testing PET Search Algorithms
- ☐ Two Diamonds
- ☐ How about a Printer?
- ☐ A Look inside the TRS-80

May 1979

- ☐ A Text Formatter in BASIC
- ☐ KIMCTR
- ☐ High-Speed Cassette Interface
- ☐ How to Talk to Your 8080 (Part 3)
- ☐ Data Base Management
- ☐ Analog and Digital Interfaces (Part 2)
- ☐ COSMAC Double Play
- ☐ COSMAC Double Play (cont.)
- ☐ From Microcomputer to Micro-Piano
- ☐ A Game of Darts
- ☐ Prettyprinting with Microsoft BASIC
- ☐ Kilobaud Classroom No. 18
- ☐ MDOS
- ☐ A TRS-80 Cross-Index
- ☐ Graphing with the TRS-80
- ☐ An All-in-One Interface

June 1979

- ☐ "Monitor"
- ☐ TRS-80/Selectric Word Processor

- ☐ Thoughts on the SWTP Computer System (2)
- ☐ New Life for Our Altair
- ☐ TVBUG
- ☐ Creative Tabulation
- ☐ A Handle on Programming
- ☐ Keypbook
- ☐ Vector Graphing Techniques
- ☐ Putting the 1802 on the S-100 Bus
- ☐ A Personal Finance System (Part 1)
- ☐ Building a New Horizon
- ☐ Microcomputers and TVI
- ☐ Translating Between TTL and RS-232 Levels
- ☐ Data Files for Processor Tech 5K BASIC
- ☐ Little Bits
- ☐ What's so Magic about the Sorcerer?
- ☐ A Telephone Data Coupler for the TRS-80
- ☐ The Cromemco Z-2D
- ☐ Personal Computing, Meet Photography
- ☐ Peripheral Interfacing

July 1979

- ☐ IC Logic Tester and Parallel I/O Expander
- ☐ Whip It! Wipeouts in the TRS-80
- ☐ HUH Electronics' Model 8100 Motherboard
- ☐ Data File Creation Program
- ☐ Computer Careers in Carolina
- ☐ Personal Finance System (Part 2)
- ☐ Sargon Meets TRS-80
- ☐ Safe I/O Ports with a Bidirectional Buffer
- ☐ Projecting Future Profits
- ☐ Randomness Is More Than It Seems
- ☐ OSI's Superboard II
- ☐ Teach an old PET New Tricks
- ☐ A Circular Handle on Graphics
- ☐ 1802 PILOT
- ☐ Red-Handed Credit Grabber
- ☐ Troubleshooting Tips and Techniques
- ☐ Super Starter Kit from Technico
- ☐ Thoughts on the SWTP Computer System
- ☐ CONOPS: an H8 Monitor
- ☐ Getting the Most out of Your TRS-80
- ☐ Reading Computer Jargon
- ☐ An Introduction to Microfilming
- ☐ The 6502 and Its Little Brothers
- ☐ Another Hexadecimal Keyboard

August 1979

- ☐ Cover Up: PET Home-Decorating Program
- ☐ Teleprinter Output for TRS-80
- ☐ Murphy's Laws and Other Observations
- ☐ Thoughts on the SWTP Computer System
- ☐ MUSKBD: Music Program for the 6800
- ☐ E-x-t-e-n-d Your Micro with the Mullen Extender Board
- ☐ The BASIC BASIC Renumberer for H8
- ☐ Shavasan Meditation Program
- ☐ Personal Finance System (Part 3)
- ☐ Percom CI-812 Mod
- ☐ Report: Financial Reports Program
- ☐ Haiku Composer: Poetry on the TRS-80
- ☐ The Sorcerer Connection: Sorcerer to Teletype
- ☐ Apple Ciphers: An Apple II Billing System
- ☐ The PAIA 8700
- ☐ Don't Throw Away That Monitor—Yet!
- ☐ Nerves: A Fast Game
- ☐ Taking AIM with Rockwell International's AIM 65
- ☐ How to Silence a Noisy Computer
- ☐ PET Wrap-up
- ☐ Machine-Language Monitors for TRS-80
- ☐ Visit to OSI

September 1979

- ☐ A Look at Terminals
- ☐ Inventory: Nine-operation Inventory Program
- ☐ Metric, English Equivalents Program
- ☐ A Look at Core Memory in Micros
- ☐ The MMS7109 Number Cruncher
- ☐ Gas-Monitoring Program
- ☐ The Fourth Faire
- ☐ Output for the SWTP Editor-Assembler
- ☐ Interfacing SOL with a Vista Disk
- ☐ The Failure of a Micro in Business
- ☐ Thoughts on the SWTP System
- ☐ 2708 EPROM for the S-100
- ☐ Review of Lear Siegler's ADM-3A
- ☐ Off-the-Shelf Word-Processing System
- ☐ Catching Bugs with Lights
- ☐ Make PET Hard Copy Easy
- ☐ Apple II High-Resolution Graphics
- ☐ Beat the Computer: Blackjack Strategy
- ☐ Put Your PET on the Betsi Bus
- ☐ Build Your Own TTL Diagnostic Aid
- ☐ Using and Expanding the Heath ET-3400
- ☐ Another KIM-1 Expansion
- ☐ Adult Caloric Requirements
- ☐ TRS-80 Speed-up

October 1979

- ☐ Thoughts on the SWTP Computer System
- ☐ PAIA 8700 Revisited
- ☐ Inexpensive TRS-80 Printer Interface
- ☐ Eyes for the AC-30
- ☐ Expanded TRS-80 Disk Operations
- ☐ Anatomy of a Scam
- ☐ Business Software Made Easy
- ☐ KIMCTR Measures Capacitance
- ☐ More TRS-80 Horsepower
- ☐ Probos V: An Inexpensive Logic Probe
- ☐ PET's Keyboard Grows Up
- ☐ Hurricane! Track Hurricanes with This Program
- ☐ Video DMA Interface for SWTP Systems
- ☐ Ultimate Consumer Computer
- ☐ The Exatron Stringy Floppy
- ☐ Calendar Program
- ☐ Four More Commands for SSB DOS
- ☐ Arena: Go into Battle with Your Computer
- ☐ File Directory Analysis for North Star DOS
- ☐ Report on the Centronics 779 Printer
- ☐ Beefing Up PET
- ☐ AMI's EVK Series
- ☐ Ulysses in Computerland
- ☐ The Apple II Programmer's Aid ROM
- ☐ Caps Lock, Not Shift Lock
- ☐ Hardware Random Number Generator
- ☐ Bit Rate Clocks for Your Serial Interface
- ☐ Exploring the Inequality of Bus Buffers
- ☐ Speed Up Your EII's Input-Output
- ☐ Load Programs the SIMPL Way
- ☐ Pig Latin
- ☐ Touch: This Icebreaker Could be a Jawbreaker
- ☐ Program Debugging
- ☐ Build an Inexpensive Logic Analyzer
- ☐ Increasing the Bytesaver's Usefulness

November 1979

- ☐ Lowercase for Your Apple II (Part 1)
- ☐ What's New in Memory?
- ☐ Stringy Floppy Encore
- ☐ The Electronic Librarian
- ☐ Text Editing for the TRS-80
- ☐ The Apple Goes to Market
- ☐ Let's Look at NEWDOS+ from Apparatus
- ☐ AMI's EVK Series
- ☐ Thoughts on the SWTP Computer System
- ☐ Payroll Program for Business Systems
- ☐ Thinker Toys' Discus I Disk System
- ☐ Expanded TRS-80 Disk Operations
- ☐ An SSM/jade Video Board for Less Than \$120
- ☐ Wave the Flag
- ☐ Real Property Profit Guide
- ☐ The TRS-80 Dial-a-Phone
- ☐ Wari: A Challenging Game
- ☐ A-Mazing, Maze-Generating Algorithm
- ☐ Sound for the EII II
- ☐ Sherlock Holmes and the Computer
- ☐ ASCII-to-Selectric Software Driver
- ☐ Introduction to TI's TMS-9900
- ☐ Have a Ball with Bally
- ☐ The Output Buffer/Driver
- ☐ Micropolis Disk Drives
- ☐ Weight-Watching Special
- ☐ \$10 PET-to-Centronics Interface
- ☐ A BASIC Dollar Edit Subroutine
- ☐ How to Build a Word Processor
- ☐ Wire-Wrap Pin Locating

December 1979

- ☐ Ithaca Intersystems' DPS-1
- ☐ Electric Bill Watchdog
- ☐ Lowercase for Your Apple II (Part 2)
- ☐ Simple Tracer for the 8080
- ☐ Chess I for Apple II
- ☐ "Sample" the Intersil/Harris 6100
- ☐ An Inexpensive and Easy EPROM Board
- ☐ Eschew Obfuscation
- ☐ Message Display in Assembly Language
- ☐ Implementing an Algorithm
- ☐ \$5 6800 Tape System
- ☐ AMI's EVK Series
- ☐ How to Choose a Small-Business Computer
- ☐ Build a SISTER for Your 6800
- ☐ Review of the S.D. Sales Expanderam
- ☐ Peak Your TRS-80 Display
- ☐ Tiny Text Editor for the 1802
- ☐ The BASIC's of Computer Art
- ☐ Reverse Video from OSI's 540 Board
- ☐ "Free" Computer Libraries
- ☐ PET's Machine Language Monitor
- ☐ A Big Switch for the H17
- ☐ Converting Selectric Keyboards to Correspondence Code
- ☐ Extending the Altair Bus
- ☐ H8 Alarm Clock Program

TM990/189 University Board

Is Texas Instruments' TM990/189 a microprocessor's microprocessor?

John Caulfield K0FUZ
2211 W. 119th Terrace
Leawood KS 66209

I don't know how many other hobbyists wait as long as I do to really get into something, but my major contact with the microcomputer world has been to read about it and just be satisfied, in a vicarious sort of way, with the fascination of the microprocessor. I've always thought that one of these days there'll emerge a microprocessor's microprocessor that I'll really learn on, become a veritable genius at and live happily ever after.

Texas Instruments' TM990/189 University Board comes closest to fitting my scenario. Time will tell if it emerges as a microprocessor's microprocessor, but you pay your money, you take your chances. TI has provided an approach that, for me, does it all: alphanumeric keyboard, display, monitor, assembler, audio cassette capability, EIA and TTY interface options, programmable I/O controller, addressable LEDs, a squeaker speaker (piezoelectric disk), matching power supply and a versatile 16 bit CPU, the TMS 9980.

One of its biggest drawing cards is 570 pages of a self-paced tutorial text. My previous reading about this sport has made me conscious of a checklist of features... TI seems to have packaged about all my

novice mind and budget could imagine into its University Board.

Let's look at the features of this 8 3/16 x 11 inch (20.8 cm x 27.9 cm) printed circuit board, which is three-hole punched so you can slip it into a three-ring binder.

The brains of the board is a TMS9980, the microprocessor. This is a software-compatible member of TI's 9900 family of microprocessors. It is a single chip CPU that has an 8 bit data bus, on-chip clock and is a 40-pin device. Wait a minute, I can hear you saying, I thought this was a 16 bit CPU. Well, it is.

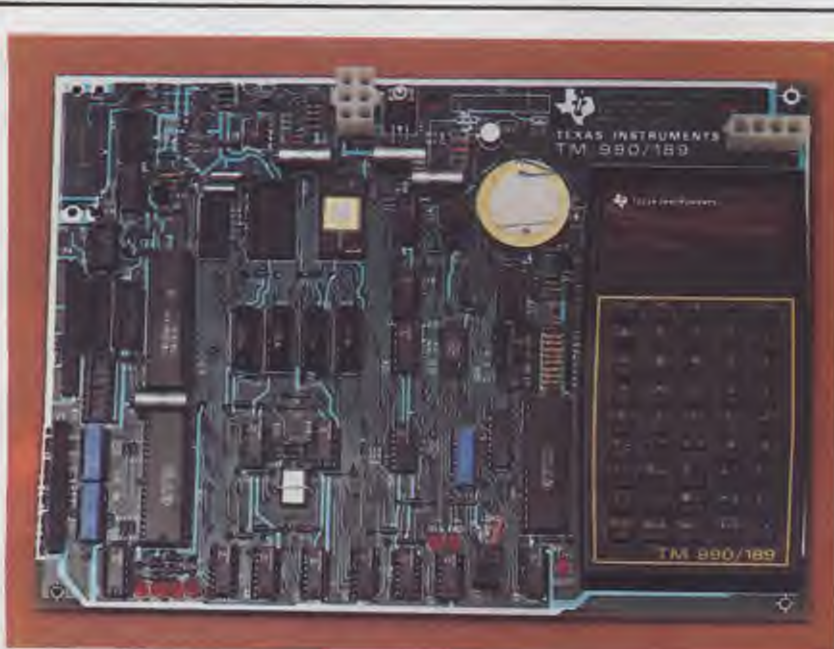
The TMS9980 has an external 8 bit data bus, but internally it has a 16 bit data bus. There's an 8 bit latch right inside the 9980. Each 8 bit data chunk that enters the 9980 via the external eight data bus pins is immediately paired up with the preceding eight bits. The combined 8 bit values form the 16 bit internal word.

Monitor Program

The EPROM resident monitor, called UNIBUG, enables you to communicate with the TMS9980. The monitor program provides fifteen commands and seven subroutines. The UNIBUG commands are shown in Table 1.

In addition to the monitor commands, there are seven utility subroutines that perform I/O functions. These subroutines are called through the XOP (extended operation) assembly-language instruction. Table 2 shows these user-accessible utilities.

The monitor program has a roommate inside the 4K PROM, a two character symbolic assembler. After entry of the A command from the keyboard, the monitor passes program control to the resident symbolic assembler. The assembler program interprets assembly-language source statements into object code. This saves you the laborious, and often error-prone, task of looking up hexadecimal op codes for any



TM990/189 University Board. (Photos courtesy of Texas Instruments)

Input Results

A	Assembler Execute
B	Assembler Execute with current symbol table
C	CRU Inspect/Change
D	Dump memory to cassette
E	Execute to breakpoint
F	Status Register Inspect/Change
J	Jump to EPROM
L	Load memory from cassette
M	Memory Inspect/Change
P	Program Counter Inspect/Change
R	Workspace register Inspect/Change
S	Single Step
T	"Typewriter" program
W	Workspace pointer Inspect/Change
Ret	New Line request

Table 1. UNIBUG commands.

one of the 69 instructions of the TMS9980, plus formatting them for various addressing modes. The resident assembler will save those of us in the microcomputer novitiate anywhere from two to three light-years of time and a like amount of debugging frustration.

Just like the "big ole computers," the University Board assembler has several versatile assembler directives (see Table 3).

Also, labels and comments can be used. Labels may consist of one or two characters—the first character must be alphabetic; the second character may be alphanumeric. Comments can be part of the source statement and may include any printable character.

Keyboard

So how do I, the lowly human, talk to this fantastic monitor, symbolic assembler and CPU? Simple, through the integral keyboard. Any breathing electronics jock knows that TI is in the calculator business. Well, they very niftily took one of their 45-key keyboards and a ten digit seven-segment display and interfaced it to the University Board. The 45 keys operate in both a shifted and unshifted mode. The keys are shifted when you depress the SHIFT key; in this mode, a shift LED is illuminated.

The keyboard display consists of ten seven-segment LEDs. All of the letters of the alphabet, numbers 0-9 and punctuations . " # , ; ? ! + - () @ / > % ^ * ' \$ = < are available. How can all this be done with seven segments?

TI uses a stylized font—which means that some of the letters and punctuations will look rather strange at first (see Example 1, which demonstrates a v, K and M). You may grow to prefer some of the stylized letters and adapt them to your everyday life. In fact, it will help keep your hobby just esoteric enough so you can still "amaze your friends."

Although the display is ten digits, it is capable of displaying any nine contiguous

characters of a maximum 64 character line. The "shift display left" and "shift display right" keys rotate the display six characters at a time in a ring buffer to enable viewing the 64 character line.

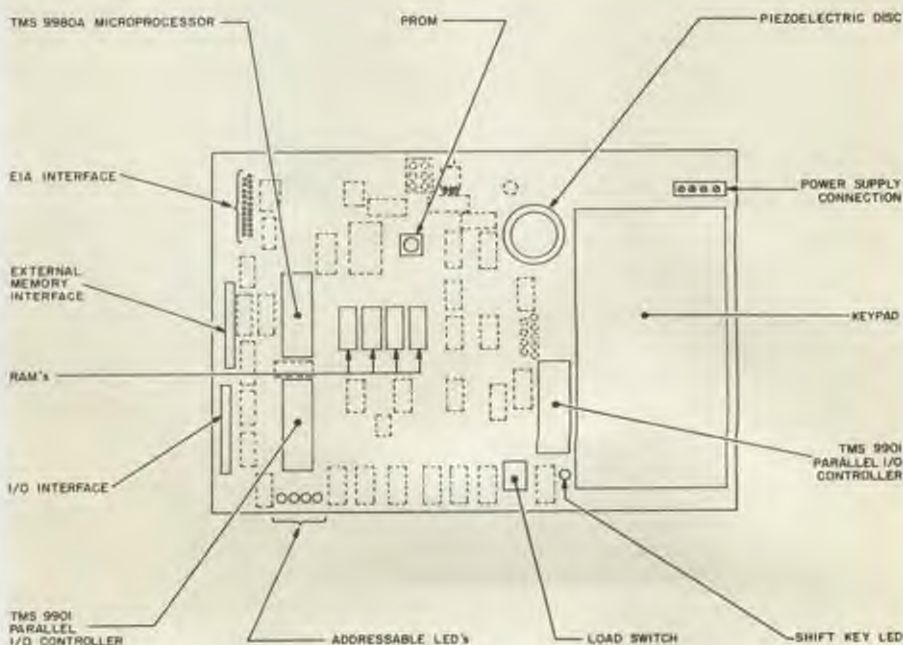
If you are an advanced enthusiast and have an EIA or TTY terminal, you can populate the EIA or TTY options on the TM990/189. The printed circuit board is predrilled and etched for the few needed parts, and the *User's Guide* details their installations.

v SHOWS UP AS \underline{v}
K SHOWS UP AS \underline{K}
M SHOWS UP AS \underline{M}

Example 1.

Memory

Every microcomputer system, by definition, has memory. The TM990/189 comes



Schematic depiction of power supply.



TM990/189 User's Guide.

with 1K bytes of RAM expandable on-board to 2K, and 4K bytes of PROM expandable on-board to 6K. The 4K PROM contains the UNIBUG Monitor and Symbolic Assembler. The user can add either a 1K \times 8 or 2K \times 8 EPROM in the expansion EPROM socket provided.

For memory expansion beyond what is on the board, all key address and data lines are brought to a 40-pin connector where additional memory may be interfaced. TI provides a bus expansion interface on the printed circuit board, which you populate to interface to off-board memory. This option will enable you to utilize the total memory address capability of the TM9980 CPU, 16K bytes.

The University Board may be interfaced to an audio cassette for mass program storage. The *User's Guide* gives the connection details and parts required. To accomplish this, again, the printed circuit board has the etches, but the user supplies the parts—a relay and a transient protection diode.

Ever since I first started reading about microprocessors, I've wondered about I/O, or, how can I get this circuit to actually do something? The University Board has two main vehicles to the outside workaday world. First, there is memory-mapped I/O that treats I/O as a memory location. Almost all microcomputer systems have

this capability; the TMS9980 CPU is no exception.

CRU Interface

The second I/O vehicle is the communications register unit, or CRU. The CRU is a definite distinguishing factor of TI's TMS9900 family. It provides for a serial transfer of one or more bits in or out of the CPU via two dedicated pins on the 9980—CRUIN and CRUOUT. A clock, CRUCLK, is used as a time strobe to coordinate data transfers. Use of the CRU does not subtract from any available memory locations, and it is separate from the data bus.

The major advantage of the CRU is "bit diddling." A single bit (or multiple bits up to 16) may be changed in the CRU output scheme. A single bit is all that is necessary to monitor or change the status of a motor, relay, switch, etc., i.e., the outside world.

There are five instructions that program the CRU interface:

LDCR—Enables the user to load from memory a pattern of 1 to 16 bits and serially transmit this pattern through the CRUOUT pin.

STCR—Enables the user to store into memory a pattern of 1 to 16 bits obtained serially at the CRUIN pin.

SBO—Sends a "logical one" through the CRUOUT pin.

SBZ—Sends a "logical zero" through the CRUOUT pin.

TB—Tests the value at the CRUIN pin and reflects the test results in the equal bit of the Status Register.

The last three instructions, SBO, SBZ and TB, are the real aids to the control applications. They enable you to turn on and off loads as well as check their status. The CRU becomes a fascinating concept beyond the typical memory-mapped I/O systems.

Power Requirements

The nominal power requirement with the on-board memory options fully populated is +5 V @ 700 mA, +12 V @ 100 mA and -12 V @ 16 mA. Luckily for me, TI supplies a matching fossil-fuel-fired power plant, the TM990/519, to supply the required "juice." If you start adding off-board options, you'll

soon run out of power supply. So keep your power budget in mind with respect to the TM990/519's capabilities.

Documentation

A major ingredient of the TM990/189 University Board package is the tutorial text, entitled *Introduction to Microprocessors—Hardware and Software*. This 500 plus page document stepped me through every inch of the system. It makes liberal use of illustrations, understandable and practical examples, and it is directly keyed to the TM990/189 for immediate hands-on reinforcement. (I especially enjoyed the illustration that built up to a Morse code translator. With a little bit of tweaking I'll be able to use it with my ham radio!)

The text is simple enough for the relative novice to use, but the book's authors (George Goode and Associates, Dallas, Texas) point out that the book can also be used as the central text in an introductory three-hour college course on microcomputer systems. The chapter titles are:

1. Overview of Computers, Microprocessors and Microcomputers
2. Arithmetic, Logic and the ALU
3. Introduction to Computer Addressing and Program Development
4. Assembly Language
5. Memory Systems
6. Input/Output Concepts
7. Input/Output Design
8. Modular Programming
9. Software Engineering
10. Product Development

In addition to the tutorial text, TI supplies a well-written 150 page user's guide. The documentation is of professional quality and highly readable.

The assembled board (no kits), tutorial text and *User's Guide* is \$299. The tutorial text alone is \$19.95; *User's Guide*, \$5.95; TM990/519 power supply, \$65. ■

XOP#	Function
8	Write one hexadecimal character to the terminal
9	Read hexadecimal word from the terminal
10	Write four hex characters to the terminal
11	Echo character
12	Write one character to the terminal
13	Read one character from the terminal
14	Write a message to the terminal

Table 2. Utility subroutines.

Inputs	Functions
AORG	Absolute origin of the statement
BSS	Block of memory reserved with starting symbol
DATA	Sixteen bits of immediate value
END	End of program, exit to monitor, load program counter
EQU	Symbol equated to value in operand
TEXT	String of ASCII coded characters

Table 3. Symbolic assembler.



TM990/189 tutorial text.



With these disks, I can turn your TRS-80 into a serious computer.

I'm Irwin Taranto, and I've put the first computer into more than 300 different businesses.

It's taught me that the TRS-80 is an elegant piece of hardware despite its low price. Given the right programs, it can jump through hoops.

Put simply, I have the right programs. Four of them are the genuine Osborne & Associates systems, originally designed for the \$30,000 Wang computer. I've made a few minor modifi-

cations, and they now work on a \$4000 TRS-80. The other two programs I added myself.

These programs are fully-documented, and you can buy the books locally or from me. I made them work on the TRS-80, and if you buy them from me, I'll make them work for you.

If you're not sure about that, call the number below and get the names of some of the people who've bought all over the world. Then ask them.

These programs cost \$99.95 each. (The Cash Journal option on the General Ledger adds another \$50.) That gets you the disk, all the instructions you need and my phone number. If you call, we answer all your questions. If your question's tough enough, I'll talk to you personally.

Because I plan to turn that TRS-80 of yours into a serious computer.

Taranto & ASSOCIATES

✓ T57
P.O. Box 6073, 4136 Redwood Highway, San Rafael CA 94903 • (415) 472-1415. Add \$3 per order for handling. 6% sales tax in California only. If you don't already have the books, add \$15 each (invoicing book, \$10). Mastercharge, Visa OK.

THE OSBORNE PROGRAMS

Accounts Payable: invoice-linked, it reports, does checks and links to general ledger.

Accounts Receivable: invoice-linked, it tracks invoices and aging, prints statement and links to general ledger.

General Ledger: handles 1750 transactions each on 200 different accounts. Cash journal option available.

Payroll: figures the pay, does the checks and all the bookkeeping.

AND MY OWN PROGRAMS

Inventory Control: gives immediate readout on any inquiry. It has many existing versions or can be individually tailored.

NEW! Invoicing: linked to accounts receivable. Prints invoices and feeds data into receivables.

STOCK CONTINUOUS CHECKS & STATEMENTS

You can take advantage of the most complete line of stock, off the shelf formats added monthly. We have an economical check that will meet your needs. You can actually save up to 60% on 1,000 checks. Delivery in either 1½ or 3 weeks.

SEND FOR YOUR FREE SAMPLES TODAY!

Are you getting this service on your check format?

Send us a copy of the check your system uses, and we will be happy to consider adding it to our stock line.



Checks To-Go

✓ C172

P.O. Box 148, Spring Valley, California 92077 (714) 460-4975

FREE

You'll save money, have fun, and learn by building it yourself — with easy-to-assemble Heathkit Computers. See all the newest in home computers, video terminals, floppy disk systems, printers and innovative software.

Send today
for your
FREE
Heathkit
Catalog



If coupon is missing, write Heath Co., Dept. 351-612, Benton Harbor, MI 49022 ✓ H49

Send to: Heath Co., Dept. 351-612, Benton Harbor, MI 49022.

Send my free Heathkit Catalog now. I am not currently receiving your catalog.

Name _____

Address _____

City _____ State _____

CL-728 Zip _____

A Not-So-Fast Renumberer for OSI BASIC

Written in BASIC, this utility makes your listings neat and tidy.

John W. Aughey
27384 Lamplighter Lane
Elkhart IN 46514

This article describes a routine that will renumber BASIC programs for the Ohio Scientific BASIC-in-ROM computers. The program itself is written in BASIC and was designed on and for my personal machine, a Challenger C2-4P. However, it has also been tested and found to work without modification on the Challenger C1-P and C2-8P machines. Hence, any OSI computer with BASIC-in-ROM can make use of this renumbering routine. I would like to thank Phil Thornton of Elkhart Computer for providing a Challenger C1-P on which to test the program.

I decided to design this program and write this article for three major reasons. First, I have been the proud owner of my C2-4P for a number of months now and, as a result, have written a sizable library of BASIC programs that I would like to tidy up and expand. Second, I hope to make a few bucks from publishing this article so I can buy more hardware to write more programs that will need to be renumbered. And finally, in a February 1979 letter to the editor (p. 20), E. Morris of Midland, Michigan, said he would not renew his subscription unless there was an article oriented toward us Ohio Scientific users in the next eleven months. I'm always glad to keep a fellow OSI user happy.

After having used their machines for a reasonable period of time, most OSI users would agree that one significant feature absent from the OSI ver-

sion of Microsoft BASIC-in-ROM is the ability to renumber an existing program. This is a shortcoming that, until recently, I had managed to circumvent manually by writing programs with large gaps in the statement numbers and renumbering manually from printed listings when the source got too shabby to share with fellow programmers. However, my professionalism (I program operating system software for an Amdahl 470/V5 to support my hobby and family) got to me recently, and I finally decided that if I can renumber by hand, then I should certainly be able to tell the 6502 how to do it by itself.

In the process of collecting ideas for an OSI renumber routine, I read a number of articles by others who have written renumber routines for other systems—some in machine code and others in BASIC, some for 6502 machines and some not. The common foundation for all of these routines is a knowledge of how the BASIC interpreter stores the user's program in memory for execution, and I knew this was the key to designing a renumber routine for OSI's version of BASIC.

OSI's BASIC-in-ROM stores a user's source program starting at decimal location 769 in RAM. Each statement is composed of a four-byte header, followed by the compressed statement and terminated with a single byte of zeros. The four-byte header contains two 2-byte data words. The first word is the address of the next sequential statement, or zeros if this is the last statement in the program. The second word contains the statement number in binary format.

Routine Design

My first attempt at writing a renumber program was designed to renumber only the statements themselves, with no consideration of renumbering GOTOs, GOSUBs, THENs or RUNs embedded in the text of the statements. This was a relatively simple task that involved chaining from one statement to the next and inserting the new binary statement number into the second data word in the header I mentioned before.

The crux of this simple-minded renumberer is contained in lines 32000-32010 of the final version (see the listing). This first attempt at renumbering proved quite useful, but it was still a nuisance to have to go back and manually renumber the GOTOs, etc.

The tricky part comes when you go back and attempt to renumber the internals of the statements. As others who have written renumber routines have found, there is an inconsistency in the way statement numbers are stored. The numbers on the statements themselves are in binary form, but the statement number references in GOTOs, etc., are in ASCII.

Fortunately, the OSI BASIC has the very useful STR\$ and ASC functions to aid in the conversion process from binary to ASCII. Luckily, the conversion in the other direction—from ASCII to binary—is not too difficult to perform in BASIC without support functions.

The OSI BASIC, as do most others, uses "tokens" to allow the compression of the BASIC source into a smaller package in

memory. The tokens are simply single-byte flags with values in the range of decimal 128-255, beyond the range of valid ASCII codes, which are used to take the place of the BASIC command verbs.

Whenever the BASIC scanner finds a string of characters it recognizes as a keyword, such as GOTO, it replaces that character string with the single-byte token that corresponds to that keyword. The renumber routine must thus scan for the tokens requiring renumbering and alter the statement numbers that follow them. In the OSI version of Microsoft BASIC, the tokens we need to look for are decimal 136 (GOTO), 137 (RUN), 140 (GOSUB) and 160 (THEN).

The renumber routine is organized into two parts. The first part is the "simpleminded" renumberer I described earlier, with one additional function. While it is inserting the new statement numbers, it also must save the old statement numbers in a chunk of RAM so the second pass will know how to renumber the internals of the statements. In OSI systems with video boards, one of the most convenient chunks of RAM is the video display memory, which begins at 53248 decimal. Each statement number saved uses two bytes, and two bytes are required for an end-of-table flag. Hence in the C1-P machines with 1024 bytes of video RAM, you can renumber a program with as many as 511 statements. In the C2-4P you can handle 1023 statements with its 2K of video RAM.

The second part of the renumberer goes back and looks at the text in the state-

DIGITAL RESEARCH

- CP/M™ FLOPPY DISKETTE OPERATING SYSTEM — Packages supplied on diskette complete with 8080 assembler, text editor, 8080 debugger and various utilities plus full documentation. CP/M available configured for most popular computer/disk systems including: North Star Single, Double or Quad density, Altair 8" disks, Helios II, Exidy Sorcerer, Vector M2, Heath H171 or H891, TRS-801, iCOM 3712 and iCOM Micro Disk plus many other configurations available on the disk. **\$145/\$25**
- CP/M version 2 (not all formats available immediately) **\$170/\$25**
- MAC — 8080 Macro Assembler. Full Intel macro definitions. Pseudo Ops include: RPL, IRP, REPT, TITLE, PAGE, and MACLIB. Z-80 library included. Produces Intel absolute hex output plus symbols file for use by SID (see below). **\$100/\$15**
- SID — 8080 symbolic debugger. Full trace, pass count and break-point program listing system with back-trace and histogram utilities. When used with MAC, provides full symbolic display of memory labels and equated values. **\$85/\$15**
- TEX — Text formatter to create paginated, page-numbered and justified copy from source text files, directable to disk or printer. **\$85/\$15**
- DESPOOL — Program to permit simultaneous printing of data from disk while user executes another program from the console. **\$50/\$5**

MICROSOFT

- BASIC-80 — Disk Extended BASIC. ANSI compatible with long variable names, WHILE/WEND, chaining, variable length file records. **\$300/\$25**
- BASIC COMPILER — Language compatible with BASIC-80 and 3-10 times faster execution. Produces standard Microsoft relocatable binary output. Includes Macro-80. Also linkable to FORTRAN-80 or COBOL-80 code modules. **\$350/\$25**
- FORTRAN-80 — ANSI 95 (except for COMPLEX) plus many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes MACRO-80 (see below). **\$400/\$25**
- COBOL-80 — ANSI 74 Relocatable object output. Format same as FORTRAN-80 and MACRO-80 modules. Complete ISAM, interactive ACCEPT/DISPLAY, COPY, EXTEND. **\$625/\$25**
- MACRO-80 — 8080/8085 Macro Assembler. Intel and Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included. **\$145/\$15**
- EDIT-80 — Very fast random access text editor for text with or without line numbers. Global and intra-line commands supported. File compare utility included. **\$85/\$15**

MICRO FOCUS

- STANDARD CIS COBOL — ANSI 74 COBOL standard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full ISAM file facility. Also program segmentation, interactive debug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal. **\$850/\$50**
- FORMS 2 — CRT screen editor. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. Output is COBOL data descriptions for copying into CIS COBOL programs. No program segmentation, interactive debug, output program directly compiled by CIS COBOL (standard). **\$200/\$30**

EIDOS SYSTEMS

- KISS — Keyed Index Sequential Search. Offers complete Multi-Keyed Index Sequential and Direct Access file management. Includes built-in utility functions for 15 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable linkable module in Microsoft format for use with FORTRAN-80 or COBOL-80, etc. **\$935/\$22**
- KBASIC — Microsoft Disk Extended BASIC with all KISS facilities, integrated by implementation of nine additional commands in language. Package includes KISS REL, as described above, and a sample mail list program. **\$995/\$45**

MICROPRO

- SUPER-SORT I — Sort, merge, extract utility as absolute executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating, fixed point, exponential, field justified, etc. Even variable number of fields per record. **\$225/\$25**
- SUPER-SORT II — Above available as absolute program only. **\$175/\$25**
- SUPER-SORT III — As II without SELECT/EXCLUDE. **\$125/\$25**

- WORD-STAR — Menu driven visual word processing system for use with standard terminals. Text formatting performed on screen. Facilities for text pagination, page number, justify, center and underscore. User can print one document while simultaneously editing a second. Edit facilities include global search and replace, read/write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning. **\$445/\$25**
- WORD-MASTER Text Editor — In one mode has supersets of CP/M's ED command and runtime interpreter. Supports full file control, chaining, integer and extended precision variables, etc. **\$109/\$15**

SOFTWARE SYSTEMS

- CBASIC-2 Disk Extended BASIC — Non-interactive BASIC with pseudo-code compiler and runtime interpreter. Supports full file control, chaining, integer and extended precision variables, etc. **\$109/\$15**

STRUCTURED SYSTEMS GROUP

- GENERAL LEDGER — Interactive and flexible system providing proof and report outputs. Customization of COA created interactively. Multiple branch accounting centers. Extensive checking performed at data entry for proof, COA correctness, etc. Journal entries may be batched prior to posting. Closing procedures automatically backs up input files. All reports can be tailored as necessary. Requires CBASIC. **\$899/\$25**
- ACCOUNTS RECEIVABLE — Open item system with output for internal aged reports and customer-oriented statement and billing purposes. On-Line Inquiry permits information for Customer Service and Credit departments. Interface to General Ledger provided if both systems used. Requires CBASIC. **\$899/\$25**
- ACCOUNTS PAYABLE — Provides aged statements of accounts by vendor with check writing for selected invoices. Can be used alone or with General Ledger and/or with NAD. Requires CBASIC. **\$699/\$25**
- LETTERIGHT — Program to create, edit and type letters or other documents. Has facilities to enter, display, delete and move text, with good video screen presentation. Designed to integrate with NAD for form letter mailings. Requires CBASIC. **\$175/\$25**
- NAD Name and Address selection system — Interactive mail list creation and maintenance program with output as full reports with reference data or restricted information for mail labels. Transfer system for extraction and transfer of selected records to create new files. Requires CBASIC. **\$79/\$20**
- QSORT — Fast sort/merge program for files with fixed record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created. **\$95/\$20**

GRAHAM-DORIAN SOFTWARE SYSTEMS

- PAYROLL SYSTEM — Maintains employee master file. Computes payroll withholding for FICA, Federal and State taxes. Prints payroll register, checks, quarterly reports and W-2 forms. Can generate ad hoc reports and employee form letters with mail labels. Requires CBASIC. Supplied in source code. **\$550/\$35**
- APARTMENT MANAGEMENT SYSTEM — Financial management system for receipts and security deposits of apartment projects. Captures data on vacancies, revenues, etc. for annual trend analysis. Daily report shows late rents, vacancy notices, vacancies, income lost through vacancies, etc. Requires CBASIC. Supplied in source code. **\$890/\$35**
- INVENTORY SYSTEM — Captures stock levels, costs, sources, sales, ages, turnover, markup, etc. Transaction information may be entered for reporting by salesman, type of sale, date of sale, etc. Reports available both for accounting and decision making. Requires CBASIC. Supplied in source code. **\$550/\$35**
- CASH REGISTER — Maintains files on daily sales. Files data by sales person and item. Tracks sales, overruns, refunds, payouts and total net deposits. Requires CBASIC. Supplied in source code. **\$550/\$35**
- tiny C — Interactive interpretive system for teaching structured programming techniques. Manual includes full source listings. **\$75/\$40**
- BDS C COMPILER — Supports most major features of language, including Structures, Arrays, Pointers, recursive function evaluation, linkable with library to 8080 binary output. Lacks data initialization, long & float type and static & register class specifiers. Documentation includes "C" Programming Language book by Kernighan & Ritchie. **\$110/\$15**
- WHITESMITHS' C COMPILER — The ultimate in systems software tools. Produces faster code than Pascal with more extensive facilities. Conforms to the full UNIX™ Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Compiler output in A-Natural source. Supplied with A-Natural (see below) requires 60K CP/M. **\$830/\$30**
- A-NATURAL — Narrative assembler with linking loader, librarian, extensive 8080 subroutine library in A-Natural relocatable format and translators from A-Natural source to Microsoft MACRO-80 source and from A-Natural rel to source. **\$330/\$15**

- POLYVUE/80 — Full screen editor for any CRT with XY cursor positioning. Includes vertical and horizontal scrolling, interactive search and replace, automatic text wrap around for word processing, operations for manipulating blocks of text, and comprehensive 70 page manual. **\$135/\$15**
- POLYTEXT/80 — Text formatter for word processing applications. Justifies and paginates source text files. Will generate form letters with custom fields and conditional processing. Support for Daisy Wheel printers includes variable pitch justification and motion optimization. **\$85/\$15**
- ALGOL-60 — Powerful block-structured language compiler featuring economical run time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling and disk address I/O etc. Requires Z80 CPU. **\$190/\$20**
- Z80 DEVELOPMENT PACKAGE — Consists of: (1) disk file editor, with global inter- and intra-line facilities; (2) Z80 relocating assembler, Zilog/Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file. **\$95/\$20**
- ZDT — Z80 Debugger to trace, break and examine registers with standard Zilog/Mostek mnemonic disassembly displays. \$35 when ordered with Z80 Development Package. **\$50/\$10**
- DISTEL — Disk based disassembler to Intel 8080 or TDU/Xitan Z80 source code, listing and cross reference files. Intel or TDU/Xitan pseudo ops optional. Runs on 8080. **\$65/\$10**
- DISLOG — As DISTEL to Zilog/Mostek mnemonic files. Runs on Z80 only. **\$65/\$10**
- TEXTWRITER III — Text formatter to justify and paginate letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting receipt documents to be created from linked fragments on other files. Has facilities for sorted index, table of contents and footnote insertions. Ideal for contracts, manuals, etc. **\$125/\$20**
- POSTMASTER — A comprehensive package for mail list maintenance. Features include keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Requires CBASIC. **\$150/\$25**
- WHATSI?™ — Interactive data-base system using associative tags to retrieve information by subject. Hashing and random access used for fast response. Requires CBASIC. **\$125/\$25**
- XYBASIC Interactive Process Control BASIC — Full disk BASIC features plus unique commands to handle bytes, rotate and shift, and to test and set bits. Available in Integer, Extended and ROMable versions. Integer Disk or Integer ROMable. **\$395/\$25**
- Extended Disk or Extended ROMable. **\$395/\$25**
- SMAL/80 Structured Macro Assembled Language — Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP, REPEAT-WHILE, DO-END, BEGIN-END constructs. **\$75/\$15**
- SELECTOR III-C2 — Data Base Processor to create and maintain multi Key data bases. Prints formatted, sorted reports with numerical summaries or mailing labels. Comes with sample applications including Sales Activity, Inventory, Payables, Receivables, Check Register, Client/Patient Appointments, etc. Requires CBASIC Version 2. Supplied in source code. **\$345/\$20**
- CPM3/374X — Has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files. **\$195/\$10**
- BASIC UTILITY DISK — Consists of: (1) CRUNCH-14 — Compacting utility to reduce the size and increase the speed of programs in Microsoft Basic and TRS-80 Basic; (2) DFFUN — Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sin, arc sin, hyperbolic sin, hyperbolic arc sin, etc. Furnished in source on diskette and documentation. **\$50/\$25**
- THE STRING BIT — Fortran character string handling. Routines to find, link, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source. **\$45/\$15**
- BSTAM — Utility to link one computer to another also equipped with BSTAM. Allows file transfers at full data speed (no conversion to hex) with CRC block control check for very reliable error detection and automatic retry. We use it. It's great! Full wildcard expansions to send ASCII, etc. 9600 baud with wire, 300 baud with phone connection. Both ends need one. Standard and M versions can talk to one another. **\$150/\$5**
- Flippy Disk Kit — Template and instructions to easily single sided 5 1/4" diskettes for use of second side in single sided drives. **\$12/\$50**

CP/M is a trademark of Digital Research.
Z80 is a trademark of Zilog, Inc.
UNIX is a trademark of Bell Laboratories.
WHATSI? is a trademark of Computer Associates.
CP/M is a trademark of Digital Research.
Z80 is a trademark of Zilog, Inc.
UNIX is a trademark of Bell Laboratories.
WHATSI? is a trademark of Computer Associates.

User license agreement for this product must be signed and returned to Lifeboat Associates before shipment may be made.

Shopping List 1.7

Software for most popular 8080/Z80 computer disk systems including NORTH STAR, iCOM MICROPOLIS, DYNABYTE DIB2, EXIDY SORCERER, SD SYSTEMS, ALTAIR, VECTOR M2, MECCA II, IBM, HEATH NT7 & HHS, HELIOS, IMSAI VDP2 & 41, REX, INTERTEC, VISTA VAD, V2000, TRS-80 MODEL II, OHIO SCIENTIFIC and IMS 5000 formats.

™The Software Supermarket is a trademark of Lifeboat Associates



Orders must specify disk systems and formats. e.g. North Star single, double or quad density IBM single or 2D-256. Altair, Helios II, Microvise Mod I or II, 5 1/4" soft sector (Micro iCOM/SD Systems) Dynabyte, etc. Please F.O.B. New York. Shipping, handling and C.O.D. charges extra. Manual most applicable against price of subsequent software purchases. The sale of each proprietary software package conveys a license for use on one system only.

Lifeboat Associates, 2248 Broadway, N.Y., N.Y. 10024 (212) 580-0082 Telex: 668585

ments, looking for the four tokens noted earlier. When it finds one of them, it looks behind it to see if there is a statement number. If the routine finds a statement number 1, it converts it from ASCII to binary and then compares it against the statement numbers that the first pass saved in the video RAM.

At this point one of two things can happen to the renumber program. The first is that it finds the old statement number in the table. If this occurs all is OK, and we proceed normally. The alternative is that the routine can't find the old statement number, in which case there was an error in your original source program, such as a GOTO with a missing destination.

Improvisations

But at this point your old program is partially renumbered, and we can't just stop renumbering. So to recover, I chose to insert percent signs (%) where the missing statement number was, to indicate in the renumbered listing that something went wrong during renumbering. It would have been nice to print an error message at this point, but doing so would have disturbed the video RAM where the old statement numbers were stored. I discovered this the hard way after much head scratching!

If the program successfully found the old statement number in the video RAM, it must now insert the corresponding new statement number in the BASIC text in place of the old number. Here is where the STR\$ and ASC functions of BASIC come in to play. One minor quirk that must be addressed here is that the STR\$ function returns a leading blank in the character string, probably where a sign would go, and this blank should be skipped over when POKEing back the ASCII characters.

At this point we run into another possible error condition. What happens if the new statement number has more digits than the original statement number and, hence, won't fit over top of it? Again, I chose

to overlay the old statement number with a special character, in this case the ampersand (&), to flag the error and distinguish this type of error from the "old statement not found" condition noted before.

A few other minor changes

leaves them alone. Since the renumberer starts at statement 31999, it will remain intact.

Operation

The procedure to use the renumber program is relatively simple. First, load in the

this program will not have statement numbers greater than 31998.

After loading is complete, key in RUN 32000 to begin renumbering. You will be prompted for the desired beginning new statement number and increment value. After this, the only visible evidence that renumbering is in process is that some apparently meaningless characters will appear at the top portion of your video monitor during the first renumbering pass: These are the old statement numbers being saved in the video RAM. These may not be visible if you are renumbering a short program on a C1-P system, due to video overscan.

After this there will be a relatively long pause, possibly several minutes, depending on the size of the program being renumbered. Be patient; do not press control-C or BREAK during this period or the program being renumbered will be left only partially renumbered, since the video RAM will be disturbed. When renumbering is completed, BASIC will prompt you with an OK, and you can proceed to list and save your renumbered program. To save or list just your renumbered program and not the renumbering code, key in LIST 1-31998, and any statements in your program will be listed.

The renumberer can be a valuable tool during program development by allowing dynamic renumbering while you are in the process of coding and testing a new program. It gives the added benefit of checking for missing destinations on GOTOs and GOSUBs that might otherwise go undetected until an unusual condition arose in program execution.

The renumberer does not affect the execution of the user program while coexisting with it in the machine, other than by occupying memory that would otherwise be available for variables. The program statements for the renumberer occupy just under 1K bytes, and the requirement for variables during execution will bring the storage requirement up somewhat beyond that. ■

```

31999 END
32000 CLEAR:PRINT"START AND INC":INPUTNF,IN
32001 AD=769:SS=53248:SN=NF
32002 SL=PEEK(AD+2):SH=PEEK(AD+3)
32003 POKESS,SL:POKESS+1,SH:SS=SS+2
32004 DS=SL+256*SH
32005 IFDS<31999THEN32007
32006 POKESS,255:POKESS+1,255:GOTO32011
32007 BT=INT(SN/256):POKEAD+3,BT
32008 BT=SN-256*BT:POKEAD+2,BT
32009 AD=PEEK(AD)+256*PEEK(AD+1):SN=SN+IN
32010 IFAD<>0THEN32002
32011 AD=769:MN=SN:SN=NF
32012 BP=AD+4
32013 BT=PEEK(BP)
32014 IFBT=0THEN32020
32015 IFBT=136THEN32023
32016 IFBT=137THEN32023
32017 IFBT=140THEN32023
32018 IFBT=160THEN32023
32019 BP=BP+1:GOTO32013
32020 AD=PEEK(AD)+256*PEEK(AD+1):SN=SN+IN
32021 IFSN<MNTHEN32012
32022 END
32023 BP=BP+1:BT=PEEK(BP)
32024 IFBT=0THEN32020
32025 IFBT=32THEN32023
32026 IFBT=44THEN32023
32027 IFBT<48THEN32014
32028 IFBT>57THEN32014
32029 FC=BP:LC=BP:DS=BT-48
32030 BP=BP+1:BT=PEEK(BP)
32031 IFBT<48THEN32034
32032 IFBT>57THEN32034
32033 DS=DS+10*BT-48:LC=BP:GOTO32030
32034 SS=53248:JS=NF
32035 I=PEEK(SS)+256*PEEK(SS+1)
32036 IFJS=MNTHEN32039
32037 IFI=0STHEN32042
32038 SS=SS+2:JS=JS+IN:GOTO32035
32039 JS=37
32040 FDR1=FC:DL=POKEI,JS:NEXTI
32041 GOTO32024
32042 AS=STR$(JS):I=LEN(AS)
32043 IFI>LC-FC+2THENJS=38:GOTO32040
32044 FDR1=FC:DL=POKEI,32:NEXTI
32045 LC=FC+LEN(AS)-2
32046 FDR1=FC:DL=
32047 JS=ASC(MID$(AS,I-FC+2,1))
32048 POKEI,JS:NEXTI
32049 GOTO32024

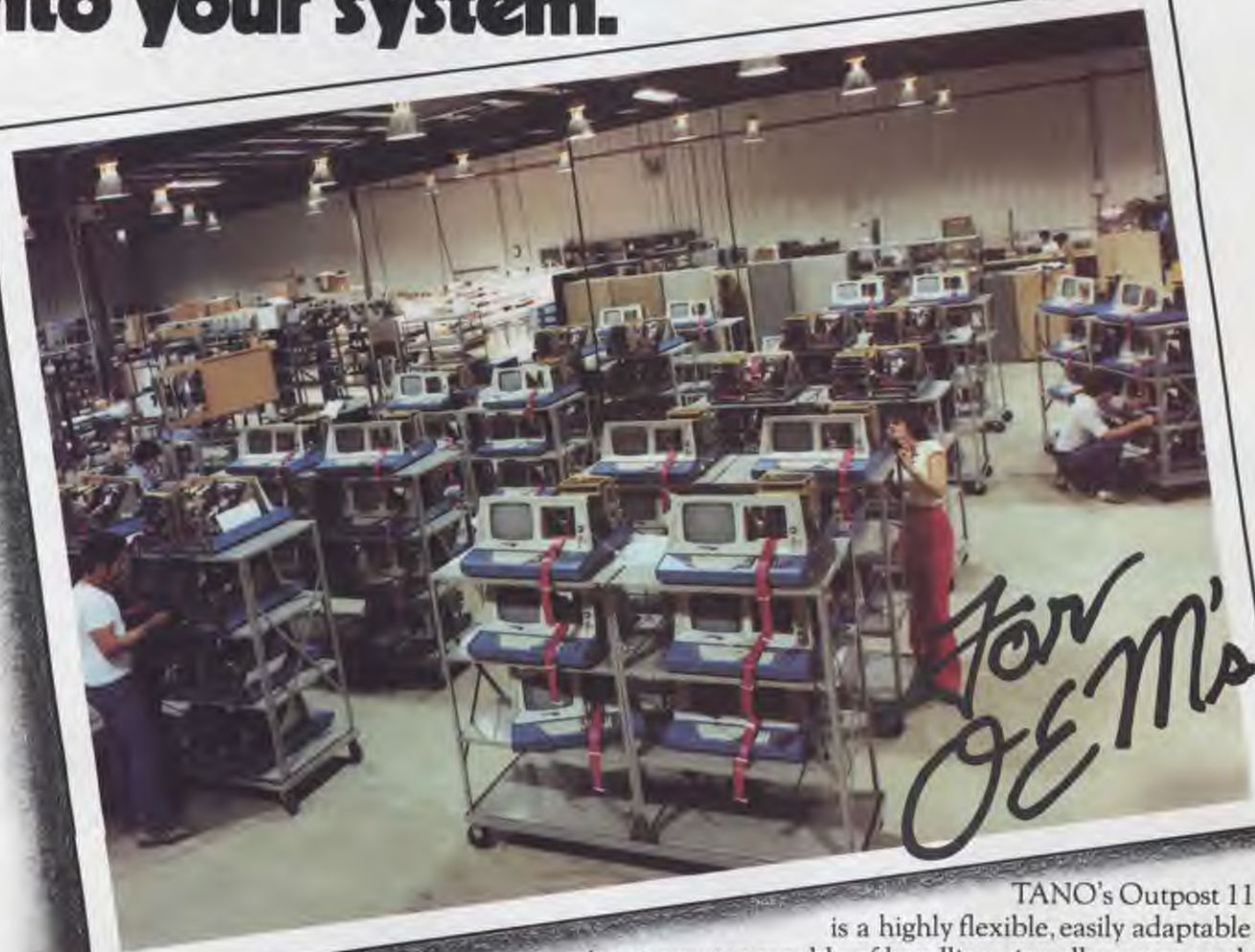
```

Program listing.

are required to make this renumbering technique work. Most important is to make sure that the program doing the renumbering does not try to renumber itself. Strange and undesirable things can happen if a program attempts to dynamically renumber itself. To prevent this from occurring, the renumber program checks for statement numbers greater than 31998 and

renumber program, which starts at statement 31999. Actually, the first executable statement is at 32000; the END at 31999 is inserted to stop a user program that terminates by falling through to the end of the program without an explicit END statement. After loading in the renumbering program, load or key in the program you wish to renumber. It is assumed that

Outpost 11 has OEM written all over it. Get it into your system.



TANO's Outpost 11 is a highly flexible, easily adaptable microcomputer capable of handling virtually any control, communications, or stand-alone small business computing application. Two points make it the outstanding choice for incorporation into OEM systems: Cost. TANO's high-volume production means Outpost 11 is available at a most attractive price, with multi-unit discounts.

Reliability. Modular design using military/industrial grade components yields 6060-hour MTBF performance.

Add to that the finest software tools and a variety of interface options (serial line, parallel, digital acquisition or analog acquisition) and you have the most versatile microcomputer in its price range.

If you're an OEM, Outpost 11 has your name written all over it. See your nearest TANO representative and get it into your system.

TANO Corporation, 4301 Poche Court West, New Orleans, La. 70129, (504) 254-3500.



TANO

T34

Visions of Sacks of Silver Dollars

Teach 'em a thing or two at the casinos with this Blackjack-strategy tutor.

Thomas W. Glaser
RR 1
Rochester MN 55901

Ahhh... Vegas and the glittering casinos filled with row after row of green-felt tables manned by the ever-efficient dealers of Twenty-one gently riffling card decks as they prepare the "shoe." Does there exist a would-be gambler who has not dreamed of making a killing at one of these tables and departing Las Vegas with a bag of some casino's loot?

I had such dreams prior to my first trip to Vegas last year. To enhance my chances for success I looked for ways to sharpen my skills before the big test, as I'm sure others do. I visited the local bookstore and found several books and pamphlets describing various methods of successfully playing these mystical games of chance for profit.

I purchased one of these sources of winning strategy for the game of Blackjack and, for the following several evenings, practiced as best I could making the correct strategic choices from many sample hands. Though the way I practiced didn't seem very efficient, I at least managed to leave Vegas with slightly more greenbacks than I had arrived with (though nothing resembling a bag was needed to carry away my loot).

Recently I was reminded once again of this need for each of

us to polish our skills prior to our try at the real thing, and the ideal practice method came clearly into focus. The idea for a computerized Blackjack tutor was born when my friend Ted strolled into my classroom one morning with that gambler's glint in his eyes. In his hands was a copy of the *Rules of Blackjack* and an airline ticket to sunny Nevada some four weeks hence.

Now, Ted is a sly fellow in his own way. He knows of my near fanatical interest in microcomputers and has a good appreciation of their capabilities. So he had come with a not-so-innocent question in mind: "How difficult would it be to create a Blackjack teacher that would deal random hands and then check my ability to make the correct choice?"

Some ideas rather easily

arouse my interest, and I had the distinct feeling that Ted knew this idea would fit that category. I had played different versions of Blackjack on several systems, but never one that had provided feedback on correct strategy. If I had only had such a tireless gambling tutor before my venture to Vegas... mmm... visions of sacks of silver dollars.

Bouyed by the idea that others (especially *Microcomputing* readers) might also benefit from such a teacher, I told Ted his tutor would be ready for some serious practice sessions before his scheduled flight to the Strip.

Blackjack Strategy

There are countless books that describe the rules and basic strategy of the game of Blackjack, or Twenty-one. The object of the game is, of course, for the player to hold a hand that has a count not greater than 21, but greater than the count held by the dealer. It is perhaps the only casino game in which the player exercises judgement and discretion in the play of the cards. Thus, the player's chances of success can be improved considerably by increased knowledge of probabilities and correct strategy.

There are several techniques the player can learn to enhance his playing ability. Some, like counting, are too complicated and require too much practice and concentration for the casual player. The strategy taught

by the tutor is condensed from several sources and consists of these simple rules:

1. When the dealer has a small card (2-3-4-5-6), stand on hands of 13-14-15-16. Draw to 12 if the dealer has 2 or 3.

2. When the dealer has a large card (7-8-9-10-ace), draw until a count of 17 or greater is reached.

3. Double down when you have:

Hard 10 except when dealer has 10 or ace

Hard 9 except when dealer has 7 through ace

Hard 11, always

Ace-2 through ace-5 when dealer has 4-5-6

Ace-6 when dealer has 2 through 6

Ace-7 when dealer has 3 through 6

4. Split pairs when you have: 2s when dealer has 3 through 7 3s when dealer has 4 through 7 6s when dealer has 2 through 6 7s when dealer has 2 through 7 9s when dealer has anything but ace-7-10

Always split aces, eights

5. For ace-2 through ace-6, draw a card if not able to double down.

6. When holding ace-7: Stand if dealer has ace-2-7-8 Double down if dealer has 3-4-5-6

Draw if dealer has 9 or 10

7. Always stand on ace-8, ace-9

These rules are summarized in Fig. 1, which diagrams the correct selections for the possible combinations of two cards held by the player and the visi-

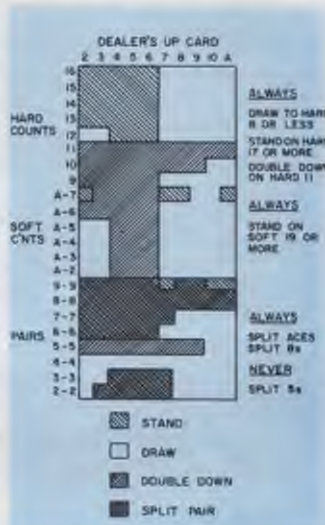


Fig. 1. Basic Blackjack strategy.


```

0512 IF D1>10 THEN D1=10
0514 IF P1<>P2 GOTO 570
0520 REM PLAYER HAS A PAIR OF LIKE CARDS
0545 REM GET THE CORRECT ACTION FROM THE PAIRS TABLE
0550 Q=P(V1,D1)
0560 GOTO 740
0565 REM CHECK EITHER PLAYER CARD AN ACE
0570 IF P1<>1 THEN IF P2<>1 THEN 670
0575 REM ONE CARD AN ACE, CHECK FOR BLACKJACK
0580 IF P1<10 THEN IF P2<10 THEN 630
0590 REM PLAYER HAS A BLACKJACK!
0600 Q=5
0610 GOTO 740
0620 REM PLAYER HAS A SOFT COUNT (ONE CARD AN ACE)
0625 REM CORRECT TABLE INDEX
0630 R=R-2
0635 REM GET CORRECT RESPONSE FROM SOFT TABLE
0640 Q=S(R,D1)
0650 GOTO 740
0660 REM PLAYER HAS A HARD COUNT (NEITHER CARD AN ACE)
0665 REM IF COUNT>17 OR COUNT<9 THEN OBVIOUS STAND OR DRAW
0670 Q=1
0680 IF R>16 THEN ON Z GOTO 740,460
0690 Q=4
0700 IF R<9 THEN ON Z GOTO 740,460
0705 REM OTHERWISE CORRECT TABLE INDEX
0710 R=R-8
0715 REM AND GET CORRECT RESPONSE FROM HARD TABLE
0720 Q=H(R,D1)
0730 REM PUT THE HAND OUT TO THE TERMINAL
0740 PRINT
0750 PRINT "HERE WE GO SAYS THE DEALER..."
0755 PRINT
0756 PRINT
0760 PRINT "THE DEALERS UP CARD IS ";C$(D)
0770 PRINT
0780 PRINT "YOU HAVE ";C$(P1); " - ";C$(P2)
0790 PRINT
0800 PRINT
0810 IF Q<>5 GOTO 870
0820 PRINT "YOU HAVE A BLACKJACK!! NO SELECTION IS NEEDED."
0825 B=B+1
0830 PRINT "PRESS RETURN FOR NEXT HAND.."
0835 A=A+1
0840 INPUT IS
0850 IF IS="END" GOTO 1140
0860 GOTO 460
0870 PRINT "IT'S UP TO YOU..."
0880 PRINT "YOUR CHOICE? SAYS THE DEALER..."
0890 INPUT IS
0895 REM GET INDEX OF PLAYERS RESPONSE
0900 RS=LEFT$(IS,2)
0905 IF RS="EM" GOTO 1140
0910 FOR I=1 TO 4
0920 IF RS=LEFT$(TS(I),2) GOTO 970
0930 NEXT I
0940 PRINT IS;" IS AN INVALID RESPONSE"
0950 PRINT "HERE'S THE HAND AGAIN"
0960 GOTO 755
0970 IF I<>Q GOTO 1060
0974 C=C+1
0975 REM THE PLAYER HAS CHOSEN CORRECTLY
0980 X=INT(3*RND+1)
0990 ON X GOTO 1080,1020,1040
1000 PRINT "VERY GOOD...CORRECT RESPONSE.."
1010 GOTO 830
1020 PRINT "EXCELLENT. CORRECT CHOICE..."
1030 GOTO 830
1040 PRINT "THE DEALER SMILES KNOWINGLY AT YOUR WISDOM..."
1050 GOTO 830
1055 REM THE PLAYER HAS CHOSEN INCORRECTLY
1060 X=INT(3*RND+1)
1070 ON X GOTO 1080,1100,1120
1080 PRINT "NO, THE CORRECT ACTION IS ";T$(Q)
1090 GOTO 830
1100 PRINT "BREAK TIME..." ;T$(Q); " IS THE CORRECT CHOICE.."
1110 GOTO 830
1120 PRINT "THE DEALER FROWNS...HE EXPECTED YOU TO ";T$(Q)
1130 GOTO 830
1135 REM END SELECTED, PRINT ATTEMPTS,CORRECT COUNTS
1140 PRINT
1144 PRINT "YOU HAVE PLAYED ";A;"HANDS. YOU HAVE CHOSEN THE"
1150 PRINT "CORRECT PLAY ";C;"TIMES AND HAD ";B;"BLACKJACKS."
1160 PRINT "TRY AGAIN SOON.."
1170 END

```

Microcomputing January 1980 79

player chooses incorrectly, the tutor will also advise the player what the correct action is for the hand. This allows the player to immediately correct his thinking for the conditions displayed and is the one item that sets the Blackjack tutor apart from other computer Blackjack games.

The Tutor Program

The Blackjack tutor is written in SWTP 8K BASIC Version 2.0, but is written to be easily adaptable to other versions of BASIC. I used only single statements per line and also avoided unusual statement types as much as possible.

The program is well commented and thus self-explanatory. To conserve memory or avoid keying, all line references are structured such that all REM (remark) statements can be removed without affecting the operation of the program. However, this alone will not allow the program to run on a 12K system; 16K is the minimum system required. If operation on a 12K system is required, elimination of lines 980-1030, 1070-1110 and possibly the instructions will be necessary.

In addition to the basic program operation described above, there are a couple of additional significant features. As a player uses the tutor and becomes more practiced, some

hands become old hat. Among these are hands with hard counts of 8 or less or 17 or more. The correct action for these hands is pretty obvious, even for the beginner. At this point, the player might wish to concentrate his practice on hands that are not quite so obvious. The tutor allows the player to select this option before the play begins.

The tutor will also keep a running total of the number of hands played, the number of correct choices made by the player and the number of Blackjacks dealt to the player. When END is entered by the player to end the session, a summary of these counts will be printed.

Final Comments

After completing the BASIC version of the Blackjack tutor, I also wrote a version in 6502 assembler for the KIM-1. This program occupies about 700 bytes of RAM and uses the KIM's keypad and display for input/output. The entries and displays are not nearly so elegant as in the BASIC version, but the strategy taught is identical. Thus, its usefulness as a learning tool for the game of Blackjack is no less than that of its bigger brother.

I will provide an object code listing and description of operation to interested persons for the cost of mailing and repro-

duction. My friend Ted, in fact, has used the KIM version as one of his prime practice tools. And as for Ted, well, he's yet to

hit the felt tables, but after all of his tutor-guided practice, he has visions of sacks of silver dollars. ■

```

BLACKJACK STRATEGY TUTOR
VERSION 2-8-79
WOULD YOU LIKE INSTRUCTIONS?
? NO

GOOD LUCK...ENTER ANY NUMBER TO BEGIN..
? 1

DO YOU WISH TO BE DEALT HANDS WITH HARD
COUNTS OF 8 OR LESS AND 17 OR MORE?
? NO

HERE WE GO SAYS THE DEALER...

THE DEALERS UP CARD IS JACK

YOU HAVE KING - QUEEN

IT'S UP TO YOU...
YOUR CHOICE? SAYS THE DEALER...
? DRAW

EXCELLENT. CORRECT CHOICE...
PRESS RETURN FOR NEXT HAND..
?

HERE WE GO SAYS THE DEALER...

THE DEALERS UP CARD IS FIVE

YOU HAVE NINE - SIX

IT'S UP TO YOU...
YOUR CHOICE? SAYS THE DEALER...
? STAND

VERY GOOD...CORRECT RESPONSE..
PRESS RETURN FOR NEXT HAND..
?

HERE WE GO SAYS THE DEALER...

THE DEALERS UP CARD IS FOUR

YOU HAVE SEVEN - TREY

IT'S UP TO YOU...
YOUR CHOICE? SAYS THE DEALER...
? DRAW

THE DEALER FROWNS...HE EXPECTED YOU TO DOUBLE DOWN
PRESS RETURN FOR NEXT HAND..
? END

YOU HAVE PLAYED 3 HANDS. YOU HAVE CHOSEN THE
CORRECT PLAY 2 TIMES AND HAD 0 BLACKJACKS.
TRY AGAIN SOON...

```

Sample run.

REAL GRAPHICS FOR PET



SHOWN WITH:

K-1007-1 INTERFACE	\$99.00
K-1008-P VISIBLE MEMORY	\$243.00
K1005-P 5 SLOT CARD FILE	\$80.00
K-1008-3C DRIVER SOFTWARE	\$20.00

CALL OR WRITE FOR OUR FULL LINE CATALOG OF PET EXPANSION PRODUCTS.

- THE FLEXIBILITY YOU HAVE DREAMED ABOUT IS NOW AVAILABLE!
- 320 WIDE X 200 HIGH RESOLUTION
- EACH DOT INDIVIDUALLY ADDRESSABLE
- SOFTWARE SUPPORT — LEVEL 1 GIVES GRAPHICS & TEXT CONTROL AT MACHINE LANGUAGE SPEED BUT ACCESSABLE FROM BASIC BY GOSUB AND VARIABLE STATEMENTS.
- DUAL PORT 8K BYTE MEMORY ON BOARD ALLOWS FULL USE OF MEMORY FOR OTHER TASKS (SEE YOUR PROGRAMS IN THEIR DIGITAL FORM IF YOU LIKE!)
- DOUBLES THE MEMORY SIZE OF AN 8K PET
- COMPLETELY TRANSPARENT SCREEN REFRESH - NO SNOW OR BLINKING EVER - THE PROPER WAY TO DO IT!

MICRO TECHNOLOGY UNLIMITED

841 GALAXY WAY
PO BOX 4596
MANCHESTER, NH 03108
(603) 627-1464

✓ M44

EXATRON STRINGY FLOPPY

Owners Association Newsletter

Secretary, Fred Waters

THE EXATRON STRINGY FLOPPY

For new readers, the ESF is a mass storage subsystem for microcomputers. Because of its speed and reliability, it does away with all the objections of using audio tape, and audio recording and playback techniques, without going to the expense of acquiring disk subsystems. The ESF is available for the TRS-80, SWTP or other 6800 systems, and S-100 bus systems. The TRS-80 version is a complete unit, ready to plug in and go, and as simple to use as the TRS-80 itself. It will load a 4K program in 6 seconds without error, and can save up to 40K on the longer tapes. Use our toll-free line below to ask for the information packet on the ESF.

ESF WORKSHOP

You would have been amazed to see what went on at a recent Saturday morning ESFOA workshop. Present was a wide range of Exatron Stringy Floppy owners and enthusiasts: professional programmers, gifted amateurs, beginners in microcomputing, and some brand new ESF owners. Several encouraging wives were there. After exchanging information on what each owner was doing, and questions and answers, there were several demonstrations of new programs and projects. One new owner showed us "WORM", a fascinating little graphics program with a worm wiggling his way all around the screen at random. Another had prepared his family and friends for Halloween by writing an interactive program with graphics and story line—scary face, startling displays, humorous dialog, and all! Others had intensively exercised the new data I/O functions (see below) for the TRS-80 version of the ESF, and had comments on the fine points of using data files. Long after the normal end of the meeting, the plant office and conference area was still full, with guys who didn't know learning from guys who did, with more detailed exchanges on individual projects,

and with discussion of what to do next.

ESFOA CHAPTERS ALL OVER

Well, you can do it too! We've had a number of inquiries from ESF owners around the US about other owners nearby. As the nationwide density of owners increases, clusters grow in the more populated areas. So we have a plan under way to get you together, to inform you of nearby colleagues. Then you too will have the benefits of meeting and exchanging information on techniques, programs, new applications and hardware augmentations.

HANDLING DATA FILES

Along with the firmware built in the ESF, you also get another significant piece of software—the Data I/O Program for the TRS-80 version, on ESF wafer. The ROM has the programs for certifying new wafers, and for saving and loading BASIC and assembly language programs. The subroutines needed for data file handling are also in the ROM, and assembly language programmers can use them. Those who prefer BASIC can use the Data I/O Program. It resides in RAM, and is delivered on ESF wafer with your system.

Well, what does it do? Those of you who have fooled with larger computers or have used disks probably already know. Let's look at an example. Say you have a household or small business inventory program in your TRS-80. The program has provision for entering items and related data, for reporting quantities, for flagging recorder reorder points, for processing cost and price data, and so forth. So you take an inventory as of January 1. Now all the data you have in the file—the raw material on which your program operates, and which changes periodically—needs to be retained until the next inventory. At that time the present data is the starting point for the changes that have occurred. So you need to save the data on your storage medium, ready to process the next time you use the program.



Dr. Lichen Wang is a physicist who learned programming simply to make his job easier. Dr. Wang has authored several highly significant software systems for personal computers. His first popular and famous program was the kaleidoscope program for the Cromemco dazzler video board. Dr. Wang is the author of Palo Alto Tiny Basic which appeared later in an expanded version as Cromemco Control Basic and was also used as the basis for TRS-80 Level I Basic. Dr. Wang wrote a robot control language called "WSFN" [Which Stands For Nothing] that can drive x-y access devices and uses very unique concepts to allow reiterative shorthand code to draw repetitive shapes. Most of the prolific output of Dr. Wang has been given away and freely published for use and modification by hobbyists.

The syntax for the Data I/O Program provides first for OPENing a numbered file on a selected drive unit. Up to eight Stringy Floppies can be operated with one TRS-80, and there can be up to 99 files on one wafer. You may open one file on each drive unit in your system, if needed. Next you use the command "@PRINT", following by a list of expressions (constants, variables and operators) to save on tape the values of the selected expressions. Finally you use the "@CLOSE" command to close the file. For multi-drive systems there is provision for designating the current drive, for closing all open files at once, and for clearing all variables and arrays.

When you want to retrieve the data, you again use the "@OPENn" command (n is the file number), and then load the data by using the "@INPUT" command, followed by a list of variables. These variables must match in type the expressions saved, and their values are loaded into memory. Again you must close the file, and you may select another drive unit or clear all variables and arrays as before.

An important point: all the commands for data I/O can be used as program statements, just as the commands for loading BASIC and assembly language

programs can. This means that you can write your BASIC program to include the functions both of creating and processing the data you are interested in, and of storing it on a data file wafer until needed again. You can probably think of—or already have thought of—many applications around the home or in a small business where you need data files.

In passing: probably the most important single conceptual feature of the Exatron Stringy Floppy is its total adaptability to any software capability you can imagine. If you need a particular microcomputer application, and if a program can be written to carry it out, the ESF can handle it for you.

INFORMATION & ORDERS

The ESF is assembled and tested at the factory, with a 30-day moneyback guarantee and a one-year full warranty. Base price for the TRS-80 ESF: \$249.50. For the S-100 ESF: \$289.50. For SWTP: \$250.00. Place credit card or COD orders using the toll-free line below for fastest delivery.

User's Manuals and a complete information packet is available for all versions of the ESF at no charge.

If you have any questions about these products, about Exatron, or about ESFOA, call the Hot Line. Address letters to ESFOA, 3559 Ryder St., Santa Clara, CA 95051.

Stringy Floppy is a trademark of Exatron Corporation ✓ E48

HOT LINE

800-538-8559

WITHIN CALIFORNIA

408-737-7111

Special from ACS... New Low Cost Add-On Storage for your TRS-80

**TRS-80 Owners . . . ACS makes it easy for you
to add-on disk storage with mini-disk storage
systems...102k bytes of additional on-line storage.**

● COMPARE AND SAVE

The FD-200 drive from ACS lets you store 102.4k bytes of data on one side of the disk...compared to only 80k bytes on a TRS-80 mini-disk drive...and 102.4k bytes on the other side, as well. That's almost 205k bytes per mini-disk, something you can't do with a TRS-80 drive. Completely compatible with your TRS-80. Can be used as No. 0, 1, 2 or 3-drive.

4-DRIVE CABLE\$35.00

● AVAILABLE IMMEDIATELY

Ready when you are...one-, two-, three-, and four-drive systems from ACS.

● NEW LOWER PRICE

Good news from ACS...a single-drive FD-200 cost you only \$375.

Add \$20.00 for DOS 3.0 disk
after September 1, 1979.

\$375.



Orders received by 6:00 p.m. shipped within 3 days on Master Charge, Visa, Certified Check or Money Order. Personal Checks require 14 days to clear. No C.O.D. Collect calls not accepted. All Hardware warranted for 90 days. Software guaranteed for replacement only. Prices subject to change without notice.

**AUTOMATED
COMPUTER
SOFTWARE SERVICE**

(615) 244-2798



Computer World INC.

625 Main Street • Nashville, TN 37206

ORDER NOW AND SAVE!

Send Check or Money Order payable to —

ACS • 625 Main Street • Nashville, TN 37206

Quan.	Description	Unit Price	Total
HANDLING CHARGE \$1.50			
TENN. RES. ADD 6% SALES TAX			
TOTAL			

☐ Check
☐ Money Order
☐ MasterCharge
☐ Visa
Card No. _____

Exp. Date _____

Name _____

Address _____

City _____

State _____

Zip _____

Business & Application Software Available

- Client Billing
- A/R • A/P
- Gen. Ledger
- Inventory
- Payroll
- Mailing List
- File Handling

for

TRS-80 APPLE

&

OTHERS

Call or Write for Details

If you're still looking
for software for your micro -
I've found that

Mad Hatter Software
HAS IT ALL.



PROGRAM

GALACTIC BLOCKADE RUNNER
SCI-FI GAME SAMPLER
R/T LUNAR LANDER
MICRO-TEXT EDITOR
OTHELLO III
AIR RAID
MICRO-CHESS
BRIDGE CHALLENGER
APPLE 21
STAR WARS/SPACE MAZE
RENUMBER
DISK RENUMBER
PILOT 2.0
PILOT 3.0
APPLE TALKER
APPLE LIS'NER
TIC-TAC-TALKER
SYSCOP
ANDROID NIM-2
SNAKE EGG
LIFE 2
DCV-1
MUSIC MASTER
DISK MUSIC MASTER
TRS-80 CP/M

DESCRIPTION

- AN EXCITING SPACE WAR GAME WITH GRAPHICS
- 3 GAMES—LUNAR LANDER—STAR MONSTER—SPACE BATTLE
- A REAL TIME LUNAR LANDER WITH GRAPHICS
- FORMAT TEXT—SAVE & LOAD TO TAPE—OUTPUT TO PRINTER
- A STRATEGY BOARD GAME—PLAY AGAINST COMPUTER OR OTHERS
- A REAL TIME, ARCADE TYPE SHOOTING GAME IN MACH. LANG.
- PLAY CHESS WITH YOUR COMPUTER—VARIOUS LEVELS OF DIFF.
- DON'T WAIT FOR OTHERS TO PLAY—YOUR COMPUTER'S READY
- BLACKJACK WITH HIRES GRAPHICS
- SCI-FI GAMES FOR THE APPLE
- RENUMBER YOUR BASIC PROGRAMS—RENUMBERS EVERYTHING
- SAME AS ABOVE, BUT ON DISK
- THE EDUCATIONAL LANGUAGE, IN MACH. LANG.—INC. EDITOR
- THE DISK VERSION OF THE ABOVE
- YOUR APPLE SPEAKS! NO NEW HARDWARE REQUIRED
- SPEECH RECOGNITION THE EASY WAY—GREAT WITH THE TALKER
- TIC-TAC-TOE USING SPEECH SYNTHESIS AND RECOGNITION
- MAKE BACKUP TRS-80 SYSTEM TAPES THE EASY WAY
- GAME OF NIM WITH ANIMATED ROBOTS AND SOUND
- A BETTING GAME WITH ANIMATED SNAKES AND SOUND
- 100 GEN. PER MIN. LIFE & BATT! F OF LIFE W/ANIMATION & SOUND
- PUT SYSTEM TAPES ON DISK EVEN IF IN SAME MEM AS DOS
- ENTER SHEET MUSIC—THE TRS-80 THEN COMPILES & PLAYS IT
- SAME AS ABOVE BUT ON DISK W/MANY SELECTIONS
- OPENS UP THE WHOLE WORLD OF CP/M SOFTWARE TO THE TRS-80

TRS-80	APPLE	PET	
L1/2	L1		
•	•	•	\$ 9.95
•	•	•	\$ 7.95
•	•	•	\$ 7.95
•	•	•	\$ 9.95
•	•	•	\$ 7.95
•	•	•	\$ 14.95
•	•	•	\$ 19.95
•	•	•	\$ 14.95
•	•	•	\$ 9.95
•	•	•	\$ 12.95
•	•	•	\$ 14.95
•	•	•	\$ 19.95
•	•	•	\$ 14.95
•	•	•	\$ 19.95
•	•	•	\$ 19.95
•	•	•	\$ 9.95
•	•	•	\$ 14.95
•	•	•	\$ 14.95
•	•	•	\$ 14.95
•	•	•	\$ 9.95
•	•	•	\$ 14.95
•	•	•	\$ 24.95
•	•	•	\$150.00

10% OFF IF YOU ORDER 3 SOFTWARE PACKAGES OR MORE SEND FOR FREE CATALOG—GIVE TYPE OF COMPUTER

TO ORDER BY PHONE OR FOR DEALER INFO—CALL—(617) 682-8131

ADD 75c SHIPPING & HANDLING • MASS. RESIDENTS ADD 5% SALES TAX

MAD HATTER SOFTWARE • 900K SALEM RD • DRACUT, MA 01826



M77

AVAILABLE FROM THESE FINE MICRO COMPUTER DEALERS

CAPITOL COMPUTER SYSTEMS
3396 EL CAMINO AVE
SACRAMENTO CA 95821

TRS-80 SOFTWARE EXCHANGE
17 BRIARCLIFF DR.
MILFORD NH 03055

OP AMP TECH BOOKS
1015 N. SYCAMORE AVE.
LOS ANGELES CA 90038

COMPUTER CABLEVISION, INC.
2617 42ND ST. NW #2
WASHINGTON DC 20007

KENNELLY SYSTEMS
74 BROAD ST.
LYNDONVILLE VT 05851

ADVANCED COMPUTER PRODUCTS
13100 L. E. HINCHER
SANTA ANA CA 92701

HOBBY WORLD ELECTRONICS
19355 BUSINESS CENTER DR. #6
NORTHIDGE CA 91324

AUGUST AUTOMATION
28 MILK ST.
WESTBORO MA 01581

THE CPU SHOP
39 PLEASANT ST.
CHARLESTOWN MA 02129

J&F ELECTRONICS LTD
28 COLLINGTON AVE.
BEXHILL-ON-SEA, E. SUSSEX, ENGL.

COMPUTER VILLAGE
921 SW 87TH AVE.
MIAMI FL 33174

L. C. SALES
100 HINCHER AVE. #701
OTTAWA, ONT., CAN. K1V4L8

An Operator-Oriented Data Base Management System

This three-part article on managing data begins with a description of the system.

Joel Shapiro
491 Kenilworth Court
Des Plaines IL 60016

It all started when I decided I needed another program that could generate some new files for storing catalog data. Going back through the many applications programs I had written in the past, I was amazed at the number of different file formats I had generated for my programs. As anything less than standardization is unforgivable in my profession (manufacturing), I decided to do something about it.

Introduction

The computer at home is used for a part-time computer service run by my wife and as a tool with which I can develop business software. A data base management system would be helpful for both uses. Considering my wife's background in office procedure (former secretary and word-processing department supervisor), I could make the program compatible with the manual systems used in many small businesses.

The problem I've run into in the past is that many existing

programs support a long learning curve from the operator training viewpoint. The unfortunate thing about this is that most small businesses will not use a computer if it won't fit into their existing procedures with a minimum of effort and change. Anticipating this and the fact that many readers would like this type of program, I decided to incorporate many prompts and error-trapping routines in the program.

As a businessman with some years of experience as a manufacturing executive, I am familiar with data base systems from the user's viewpoint. This has helped in developing this program in that many of the features of some existing commercial programs are not used and other features are desired.

I have selfishly written the program with my own prejudices in mind, and I believe an operator, with very little training, can make use of the system. No attempt has been made to conserve memory or increase speed at the expense of operator convenience, operator assistance or system flexibility. The compromise in speed is not limiting for personal computer use and is within the requirements of a small business that will use the

computer to supplement a small staff.

The program was written to run in my system, which has 48K of memory. Although much of the memory is used by the interpreter and approximately 2K is used for the display at the top end, it has proved to be enough for the program. The system also has dual disk drives, each capable of 315K of storage, and a printer capable of 132 characters per line. I feel that this may represent the system a small business would use.

The programs can be changed to suit individual systems by use of the chain feature of Micropolis BASIC for smaller program segments. The elimination of many of the prompts, error traps, messages and remarks can also save memory, but this may compromise operator convenience and promote error. Additionally, a few of the subroutines will have to be changed to suit the user's terminal. Those written in the program support a Merlin video board, which is not too common.

Part 1 of this three-part article will describe the features and operations of the program, leaving the description of the code itself for parts 2 and 3. I will cover explanations of features

used in Micropolis BASIC and possible changes the reader may desire.

Program Features

1. Full prompting, with many error traps, error messages and subroutines, which make it easy to learn.
2. Up to 30 fields for data, each of any length as long as the total of all fields does not exceed 248 characters.
3. Field titles up to 18 characters.
4. Complete edit function for all data.
5. Data can be deleted from one file and added to another automatically.
6. Automatic formatting of dates.
7. Automatic search for any entry in any field.
8. Automatic formatting of dollar fields.
9. Data recovery utility program for use in case of program crashes.
10. File parameters remain on disk and can be changed by the user.
11. Report format is selected by the user, including all elements of the heading.
12. Report format can be retained on disk for future use as well.

FILE FACTORY PAYROLL FILE CODE 1
FILE CREATED 07/05/79 FILE UPDATED 07/29/79 14 ENTRIES

NAME	STREET	CITY	ST	ZIP
GEORGE ABBOTT	345 LENDER AVE	MATCOON	IL	62332
GEORGE BROWN	99 DENVER AVE	ALBION	IL	67766
MARYANN E. BROWN	678 N. MARINE DR.	CHICAGO	IL	60606
KAREN J. BROWN	19 WOODDALE AVE	CANOGA	IL	66600
DANIEL J. HUDSON	55 NORTH AVE	CHICAGO	IL	60789
JAMES C. JOHNSON	8954 WOODVILLE AVE	DENPSEY	IL	61123
KEITH JONES	999 WEST DRIVE	SAMPSON	IA	23999
GLADYS B. METZ	54 WINDSON LANE	CRETE	IL	61134
LAWRENCE PASTERNAK	23 PANSY LANE	ODESSA	IL	60111
GERALD PETERSON	886 FORMOST DR.	WINNEBAGO	IN	47768
ROGER SMITH	345 WOOD AVE	ASPEN	IL	60894
JUAN VALDEZ	134 E. 54TH ST	AKRON	IL	60923
EDWARD G. WYNN	244 LAMPSHON DR.	CLARK	IL	61138

Listing 2. Address list name sort.

tant that DATABASE be the first program used.

The CREATE program provides all of the functions required for creating the file itself, the parameters of which are written into the first five records of the file. Information written into the file by this program is as follows:

File code—I use a numerical code (0-99) to control file access by application programs. It can be alphanumeric and up to 30 characters long if desired.

Special filename/purpose—A string of up to 30 characters—used on reports if actual filename is to be guarded or if purpose such as Payroll, Mail List, etc., is to be printed on the report.

Number of fields—Added by program when file is created.

File create date—Date entered when program was initialized and CREATE program used to create a file.

All of this data is written into record 1 of the file. Additional information such as print options, records to be deleted, file updates, etc., which are used elsewhere in the system, will also be retained in record 1. This saves time in reentering a lot of data and also provides continuity to the system.

The title, size, type code and operator access key for each field is written into records 2-4.

Fields—A field is where a single element of data is stored. The data is accessed from the file by accessing the field. If you picture a printed report with several columns, each column will represent a separate field.

Each field must have a title; a maximum of 18 characters is allowed for each title. Certain features, which are described later, are keyed into a portion of the title, so the title for the field must be decided carefully.

When data is entered into a field, blanks are added to fill out the data string to the selected field length. This is done so the field data can be accessed correctly in all routines. The field codes (N, S and D, meaning numerical, string and dollar, respectively) determine how this is done. All S fields are padded from the right so all string data is left justified when printed. All N fields are padded from the left and are right justified. D fields are padded from the right, but are formatted in the REPORT program.

It is extremely important that the size of a D field allow for the the decimal point and 1/100s (cents) in addition to the space required for whole dollars. No space need be allotted for a dollar sign or commas, as these will be added in the REPORT program.

If a decimal point is used in N fields, don't expect them to line up in printed reports. Because the number of digits to the right of the decimal point is not always known, the field cannot be readily formatted. However, data consisting of a whole number will be right justified.

Certain features are keyed from the first four characters of a field title. When read as *name*, the field is designated as S, and subsequent programs will allow reversal of the first and last names. Names should be en-

tered as follows for correct processing: enter the last name, comma, space and first name. The program will search the string for the comma and reverse the string from that point.

When read as *date*, all programs will provide for correct formatting of the date string. All dates must be in a date field for proper handling of the data.

When the first four characters are read as *AMT.*, the field is set as a D field. If you don't want to use *AMT.* in the title, it is still possible to designate the field as a D field. Correct formatting will not occur if the field is not coded D.

File Maintenance

The file maintenance program, MAINT, is responsible for controlling data entry, editing and removal with regard to the file. When MAINT is called by DATABASE, a menu to allow selection of one of its many functions will be displayed.

After a filename is given, the program causes the computer to search for the file. In a multiple drive system such as mine, drive 0 is checked first, and if the file has not been found, drive 1 is checked. If the file is not found on either drive, then an error message is displayed. When the file is found, the first five records are read and some of the information is displayed on the screen. The operator can then add data, delete, modify (edit), search and review the file entries as desired. The file is updated as each record is modified or added.

An auto delete function will allow deletion coding of all rec-

ords in which the entries within a selected field are between upper and lower limits as selected by the operator. This does save considerable time whenever a group of entries are to be deleted.

Note at this time that the records are only coded for deletion. When so coded, they will not be displayed, printed or used in other programs except SORT-FILE. Records coded for deletion, however, can have the coding removed within the modify function of the MAINT program. The program was written this way because restacking the file (which removes the coded data) does take considerable time. This is something you may wish to do when you have it, or when you need the file space.

The DELETE program has the responsibility for this function. DELETE is chained from MAINT and is considered part of the MAINT program. When the data has been deleted and the file restacked, any unused tracks are reallocated as open tracks.

Options available in the program include transferring coded data to another file or just deleting the data.

In the case of deleting to another file, the file parameters must be the same in both files; the only difference can be in the filename. For this reason, the utility routine in the CREATE program, which duplicates the file parameters, should be used. Coded records transferred to the file before deletion will be added in sequential order and in the order in which they are transferred. The main reason for transferring to another file is to allow deletion of data from active files and storage of this data for historical reference.

Sorting

The SORTFILE program is capable of multiple-level sorting. This means that it has the capability of sorting into major categories and minor categories, each within the other. For instance, with a mailing list file you can first sort by state, then zip code within a state, town within a zip code and street within a town.

When the program is called, it

will request the primary sort field (which should be a major category) and the subsequent minor fields. Up to ten levels can be sorted in this fashion. Take care in choosing the primary field. If name is a primary field in a sort of many levels, there will be no apparent sort unless many John Smiths are in the file.

Sorting takes time! The more levels selected, the more fields in the file, the more data to sort and the longer it takes. In my tests, 100 entries in a four field, two level sort took 7 1/2 minutes. Nine hundred entries in the same file took 1 1/2 hours.

As sorting takes place the screen will show a descending progression of numbers. This is only to show the operation of the program and the progress of the sorting task. The closer to zero, the closer it is to completion.

When the file has been sorted, the locations of the sorted entries in the master file are located in an index file. The index file stores data in a different format than do the data files. Index information for 1200 file records can be stored in only three tracks of index file. In most cases, this will permit you to store a master file and one or several index files on a single disk.

Up to 1160 data entries and one index file can be placed on a disk. The maximum number of data records allowable, using a full disk, can only be 1211, so the sacrifice of 51 data entries may be warranted in keeping the files together. Don't worry about it!

After sorting, if the program determines there is not enough space on the disk for the index file, it will advise the operator. A new index file can then be created within the program without the loss of the stored data. It is best to create (name) the index file before starting the sort, but it can be done the other way around. The index file can be located on another drive without hampering system operation.

No data is changed in the sorting process, and the master file is not changed. Many index files can be made for the same master file depending upon the sorting requirements.

Remember: All file data is considered in the sort. If data is added or deleted to or from the master file, the file will have to be resorted. If the data is modified in one of the fields used in the sort, the file must be resorted. It is therefore best to make any changes before sorting.

The Report Generator

The REPORT and PRINTER programs produce the printed report in one of several different formats selected by the operator. I used a kind of "salad bar" approach in that the report parameters and features are all operator selected, mainly by answering yes- and no-type questions.

One of the pet peeves of a business executive is that he can't get the report he wants without waiting several weeks for priority in a data processing department. That has been expressed to me upon several occasions at various trade meetings and seminars. A good case for the micro!

It is unfortunate because in some large businesses that have large computers, large sums of money can be lost if the file information isn't available. The impact of the same problem on a small business can sometimes be disastrous.

Have no fear! I believe this approach to getting the information from the files requires very little training and can be used by the person requiring the report without a problem and, I hope, without a loss.

When REPORT is called, the file accessed and the parameters displayed, the operator is requested to enter the fields (by number) wanted in the report and in the desired sequence. Only the fields requested by the operator will be printed. If all fields are to be printed, just enter ALL, and the fields will be printed in file sequence. If the letter T is entered directly after the field number, when the field is an N or D field, the total amount for all entries with that field will be printed at the end of the report.

The operator is then requested to select other options,

mainly about the report heading. The field selection, options selected and fields selected for totals are normally retained in the file. After the report is printed, the operator can have this done by selecting the option. This way, the information need not be entered again unless there are changes. It is also possible to generate a report with a different setup without destroying the options already recorded in the file.

After field and option selection, the operator is asked to insert a new line width if different from the 132 character default assignment. This permits the use of different width paper without difficulty.

If a name field is to be printed, the operator is asked if the first and last names are to be reversed. Remember, they are last name first in the file.

The final feature for selection is the determination of upper and lower limits for data in the report. The default of this option is to print all entries. Use of the limit feature permits the opera-

tor to select a field to use for the control and to set the limits within that field.

It is therefore a simple matter, for instance, to select a date billed field and print out only the entries with billing between 90 and 120 days old, printing out the outstanding balance as well! This feature works along with the sort so the information is printed in sorted fashion and within the selected limits.

The sorting and the limit routines will work even though the fields used for either or both of them are not used in the report. As you can see, the flexibility offered to the operator is tremendous in that a report may be printed in a manner tailored for his needs. The versatility of the system is further demonstrated in the sample runs. To assist in demonstrating the system, I created a short file that resembles what might be considered the payroll data file for a small business.

In Listing 1, the file is printed in its entirety alphabetically. Note that when the number of

FILE FACTORY		PAYROLL	FILE CODE 1	
FILE CREATED 07/05/79			FILE UPDATED 07/29/79	14 ENTRIES
NAME	DATE HIRE			
KEITH JONES	05/12/66			
EDWARD G. MYNN	04/31/67			
DANIEL J. HUDSON	04/04/69			
KAREN J. BROWNE	01/21/72			
ROGER SMITH	05/06/73			
GEORGE BROWN	06/03/74			
JUAN VALDEZ	05/12/75			
GEORGE ABBOTT	04/31/76			
GLADYS G. METZ	05/13/76			
JAMES C. JOHNSON	06/15/76			
LAWRENCE PASTERNAK	07/07/77			
MARYANN E. BROWN	06/07/78			
GERALD PETERSON	09/21/78			

Listing 3. Seniority list.

FILE FACTORY		PAYROLL	FILE CODE 1	
FILE CREATED 07/05/79			FILE UPDATED 07/29/79	14 ENTRIES
DEPT	HR/PAY	LD	DATE HIRE	EMER PH
103	\$ 7.93	12	05/12/75	335-6789
103	\$ 8.45	13	05/06/73	234-5678
105	\$ 5.25	8	07/07/77	NONE
105	\$ 5.50	9	06/15/76	444-5555
111	\$ 13.50	23	05/12/66	222-1122
112	\$ 5.80	10	05/13/76	662-4578
116	\$ 5.80	10	09/21/78	555-3456
123	\$ 7.54	12	04/31/76	132-1321
123	\$ 7.75	12	01/21/72	333-3333
123	\$ 25.00	23	04/04/69	355-6879
124	\$ 50.00	41	04/31/67	666-9944
245	\$ 6.93	11	06/03/74	343-3232
300	\$ 6.50	11	06/07/78	123-9876
TOTAL HR/PAY = \$		155.95		

Listing 4. Sort by department.

FILE FACTORY FILE CREATED 07/05/79	PAYROLL	FILE CODE 1 FILE UPDATED 07/29/79	14 ENTRIES
NAME	DEPT	EMER PH	
ABBOTT, GEORGE	123	132-1321	
BROWN, GEORGE	245	343-3232	
BROWN, MARYANN E.	300	123-9876	
BROWNE, KAREN J.	123	333-3333	
HUDSON, DANIEL J.	123	355-6879	
JOHNSON, JAMES C.	105	444-5555	
JONES, KEITH	111	222-1122	
METZ, GLADYS G.	112	662-4578	
PASTERNAK, LAWRENCE	105	NONE	
PETERSON, GERALD	116	555-3456	
SMITH, ROGER	103	234-5678	
VALDEZ, JUAN	103	335-6789	
WYNN, EDWARD G.	124	666-9944	

Listing 5. Emergency phone number list.

FILE FACTORY FILE CREATED 07/05/79	PAYROLL	FILE CODE 1 FILE UPDATED 07/29/79	14 ENTRIES
NAME	DEPT	EMER PH	
GEORGE ABBOTT	123	132-1321	
GEORGE BROWN	245	343-3232	
MARYANN E. BROWN	300	123-9876	
KAREN J. BROWNE	123	333-3333	
DANIEL J. HUDSON	123	355-6879	
JAMES C. JOHNSON	105	444-5555	
KEITH JONES	111	222-1122	
GLADYS G. METZ	112	662-4578	
LAWRENCE PASTERNAK	105	NONE	
GERALD PETERSON	116	555-3456	
ROGER SMITH	103	234-5678	
JUAN VALDEZ	103	335-6789	
EDWARD G. WYNN	124	666-9944	

Listing 6. Sequence of fields has been changed from Listing 5.

columns exceeds the page length margin, the line is broken at the beginning of the next field and a new line is started with an offset of five characters. The offset is provided to allow the reader to align the column with the title when the report is read. This report was set for double spacing, which occurs after the line has been completed. Note also that the data is aligned with the first character of the title. This approach, rather than centering the title, seems to make it easier to read.

Note that the total for the hourly pay (HR/PAY) field is printed at the bottom of the report.

Column width is determined by a subroutine that determines the largest field size, title length or dollars as formatted. To this, two spaces that determine the spacing are added.

Listing 2 is an address list sorted alphabetically by name; the first and last names have been reversed by the program.

Listing 3 is a seniority list sorted by hire date.

Listing 4 shows a sort by department, LG (labor grade) and hourly pay. Note that the hire date and emergency phone are also printed. The hourly pay field is totaled.

Listing 5 is an emergency phone number list for all employees. The same alphabetical sort by name, as used in Listing 2, is used here.

Listing 6 is the same as Listing 5, except the sequence of the fields is changed.

The sample runs shown here are indicative of the type of report preferred by the business user, with the flexibility required by the home computer owner. However, the report you request

is really limited only to what you desire, providing it is within the capabilities of the system.

The Recovery Program

The axiom regarding necessity and invention applies fully to my development of the RECOVERY program. One stormy day, while I was entering data into my music catalog file, we experienced a power failure in the area. Although the power failure was momentary, it was of long enough duration to drop the data in RAM. I had started the day with about 100 entries in the file and had added about 600 more.

The MAINT program adds the data to the file as each entry is complete, but the end of file marker used by the disk system was never reset. In other words, only 100 records of the file could be accessed by the computer.

The RECOVERY program permits the operator to move (or step) the end of file marker to the first incorrect (garbage or empty) record and reset the marker. When reading the data displayed by this program, keep in mind that the data isn't broken down into fields. However, it is clear enough for the operator to recognize good data and make the end of file determination.

It is a good idea to make a backup copy of the file before working with it. It is always possible to wipe out your data base due to a hardware or software fluke in the system.

This completes the description of the features and operation of the data base management system. Next month, in part 2, we will begin examining the actual BASIC programs that comprise the system. ■

IRIDIS™

The Original Cassette Magazine for the
ATARI®

- IRIDIS is a cassette magazine of programs for the ATARI 400 and 800 personal computers.
 - Four excellent programs on a high quality C-30 cassette, ready to load and run.
 - Each issue has an animated "Front Cover" that will delight your eyes!
 - With each cassette you get IRIDIS Notes, a lively newsletter of information about the ATARI computer.
 - IRIDIS brings you fun and games, education, business programs and "software tools" that will help you enjoy your ATARI.
- 4 issues for \$14.95 in US & Canada
□ Sample copy \$4.95
Calif. residents add 6% tax.
We Accept VISA and Mastercharge
IRIDIS, Box 550, Goleta, CA 93017
Programs for your ATARI®

PET PERIPHERALS

(FOR OTHER IEEE 488 BUS COMPUTERS, TOO)

NEW — RS-232 INTERFACE: \$229

The TNW-2000 Bidirectional Serial Interface allows keyboard input as well as printer output. The unit provides selectable automatic PET/ASCII character conversion, "throttled" output, baud rate adjustable from 110 to 9600 bits per second. \$229 price includes power supply, cabinet, PET/IEEE cable, built-in female EIA connector, full documentation. (For software controllable RS-232 control lines, and multiple RS-232 devices, TNW offers the TNW488/232 Serial Interface. Price is \$335, includes power supply, cabinet, PET cable, full documentation.)

MODEM

The TNW488/103 Low Speed Modem is Bell 103 compatible, provides auto originate/answer/dial capabilities. 75 to 600 bits per second. Interfaces to phone system via DAA. Price of \$385 includes power supply, cabinet, cables to PET and DAA, full documentation and software.

(The Net Works is now)



TNW Corporation T58

Ask your dealer or contact —
ASTRONICS • (714) 278-5441
3351 Hancock St. • San Diego CA 92110

TRS-80 LEVEL II and Disk Programs

MULTIPLE REGRESSION 2.0—A disk based package of chained programs that permits model estimation using thousands of observations. User specified transformations (write them in BASIC during execution). X-Y plots, formatted for screen or printer + all features of Multiple Regression 1.0. **\$45.00**

LEVEL II 16K PROGRAMS

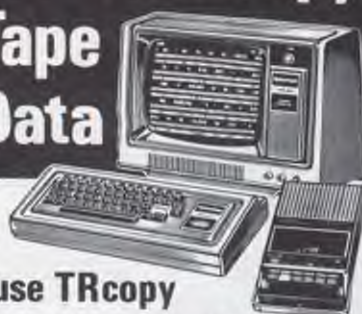
Multiple Regression 1.0..... **\$29.95**
Linear Programming..... **\$29.95**
0-1 Programming..... **\$29.95**
Transportation Algorithm..... **\$29.95**
Heuristic Line Balancing..... **\$29.95**
Stat. Pack—median, mode, mean (avg., harmonic, geometric), variance, histograms, Tests (T, X², F), one variable regression, one and two-way ANOVA..... **\$9.95**
Differential equations—6 methods..... **\$29.95**
Queueing Statistics..... **\$14.95**
Eigen Value/Eigen Vector..... **\$45.00**

LOWERCASE MOD—Includes excellent documentation + all parts (nothing else to buy), compatible with Electric Pencil..... **\$14.95**
Documentation available at \$5.00 per copy.



Available in Disk add \$3
I.C. residents add 4% sales tax
Overseas orders add \$3 for shipping
p.o. box 628
charleston sc
29402

See and Copy Tape Data



use TRcopy WITH YOUR LEVEL II TRS-80*

TRcopy is a cassette tape copying system that lets you SEE what your computer is reading.

COPY ANY CASSETTE TAPE**

With the TRcopy system you can copy any TRS-80 Level II cassette tape whether it is coded in Basic or in machine language. You can also copy data created by programs and you can copy assembler listings.

YOU CAN SEE THE DATA

As the tape is being loaded, you can SEE the actual data byte-for-byte from the beginning to the end of the program. Up to 320 bytes are displayed at one time. ASCII characters are displayed on the first line and hexadecimal code is displayed on the following two lines. Data is displayed exactly as it is input including memory locations and check sums.

IDENTIFY PROGRAMS

With TRcopy you can identify programs on cassette tapes without written documentation because you can SEE the filename. If you forget to label a tape, you can use TRcopy to display the tape contents and identify the cassette.

VERIFY CASSETTE TAPES

With TRcopy you can verify both the original tape and the tape copies. You can make certain that your machine reads the original tape correctly and that it makes byte-for-byte copies. TRcopy also counts as it reads giving you the exact length of the data.

MAKE BACKUPS FOR YOUR PROGRAMS

Now you can make backup copies of your valuable programs. Many times a cassette that you make will load better than one that is mass produced. The original can then be kept as a backup in case the copy is damaged.

MAKE COPIES OF YOUR SOFTWARE

If you are in the software business you can use TRcopy to make tested copies of your programs for sales distribution. TRcopy produces machine language tapes that are more efficient than those produced by the assembler itself.

RECOVER FAULTY DATA

With TRcopy you can experiment with the volume and level controls and you can SEE what the computer is reading—even if your computer will not read the data through normal read instructions! In this way it is possible to read and copy faulty tapes by adjusting the volume control until you SEE that the data is input properly.

SIMPLE - FASCINATING - FUN

TRcopy is not only a practical utility program, it is also a fascinating graphics program that lets you SEE, for the first time, cassette data as your computer is reading it. And it's as simple as 1-2-3. Just load, verify and copy. You will now be able to use cassette tapes with confidence knowing that TRcopy is there when you need it.

The TRcopy system is a machine language program with documentation explaining tape leaders, sync bytes, check sums and other formatting conventions. With the TRcopy system, you can SEE what you are doing!

TRcopy System Including
Cassette Tape and Documentation

39.95
POST
PAID

Orders accompanied by money order
or cashier's check mailed same day.
Orders paid by other check shipped in 14 days. No COD's. Return
within 10 days for a full refund if you are not satisfied.

N.D. Orders Add: *TRS-80 is a trademark of the Tandy Corporation. **You cannot copy the
3% Sales Tax. TRcopy cassette.

ORDER FROM

Data/Print

DEPT. KB, BOX 903, FARGO, N.D. 58107

CALL IN
YOUR
ORDER
Now!

Call Toll-Free 24 Hours

If you have a Master Charge or a Visa credit card, you can call toll-free from the nearest telephone and have your TRcopy system on its way to you today.
Call 1-800-437-4144 anytime - 24 hours a day.

For calls from N.D., Hawaii or Alaska call collect 1-701-237-0216

CALL RIGHT NOW!



NOW USE TRCOPY WITH YOUR PRINTER

Included at no extra cost - Now you can use the TRcopy system to output tape data to a line printer or a quick printer. The data is printed exactly as it is input from the tape including file names, memory locations and check sums. A printed copy can be especially helpful in the analysis or recovery of records contained in tape data files.

ORDER YOUR TRCOPY SYSTEM NOW!

DSO

TOLL FREE

24
Hours
SAME DAY
SHIPMENT

QUALITY BIMONTHLY COMPUTER SOFTWARE

SINCE 1978
ACROSS THE U.S.A.
AND IN OVER
18 COUNTRIES



STILL ONLY
\$12/YEAR - U.S.A.
\$24/YEAR - FOREIGN
AIRMAIL

SUBSCRIBE
NOW!



P.O. Box 2571
Kalamazoo MI 49003

YES! Send mine IMMEDIATELY to:

Name _____

Address _____

City _____ State _____ Zip _____

☐ My check is enclosed.

Bill my ☐ Mastercharge # _____

☐ Visa Expires _____

A Relocator for North Star BASIC

See how many uses for this application you can locate in this article.

Having had about a year's experience working with the North Star minidisk system, I think I can safely say that it is a convenient little unit. Both the hardware and software (DOS

and BASIC) provided seem to be reasonably well thought out and work together satisfactorily. Even though I've since acquired a second drive and some more sophisticated software, I still find myself reaching for the North Star BASIC/DOS combination when I want to write a quick and dirty program, because I can start writing in just about nothing flat.

The system has a certain simplicity that I find attractive, even though the file-managing capabilities aren't quite as convenient as, say, the version of CP/M for minifloppy systems. Still, I think most owners will agree that they now have their hands on quite a nice, cost-effective system, especially when they stop to consider that most of us who bought such a system were able to retire older, less convenient cassette or paper tape systems.

Lest I be accused of writing an ad for North Star, I think it's only fair to say that I think they did miss the point on a couple of matters when they designed their software. One of my nagging questions has always been: "Why on earth did they start the standard DOS at 2000H instead of something more logical (0000H)?"

I'm sure I'm not alone in saying that it can cause some inconvenience, especially if you're running a different system part of the time and want

your memory to start at 0000H, whereas with North Star BASIC you gain the most space for programs if your memory is addressed starting at 2000H.

Although I've lived quite nicely with this for a year or so, the idea struck me recently that it might be nice to be able to relocate the system to take better advantage of the available memory and not have to be constantly readdressing memory boards. Of course, you can purchase a custom version of either DOS or BASIC from North Star for your own special configuration, but this requires a minor capital outlay. Besides, with a relocater of your own you could create as many different versions as you had a use for at no expense or inconvenience... and perhaps have some fun doing it.

Relocation

To digress for a moment into the principles involved in moving a language such as BASIC from one part of memory to another: The primary obstacle when dealing with any software written for the 8080 is the lack of any indexed or relative addressing scheme. This means that a program must reside in a particular part of memory to run correctly. If it is moved without changes to somewhere else and then executed, all bets are off. And if you have a memory-mapped video as I do, you'll probably see all sorts of funny patterns sudden-

Relocator program.

```
10 REM RELOCATOR FOR NORTH STAR BASIC, REL. 4
20 REM WRITTEN BY LANCE E. ROSE, 4/79
30 REM
40 REM FIND OUT IF 8 OR 14 DIGIT VERSION
50 PRINT
60 INPUT "8-DIGIT OR 14-DIGIT? ",QS
70 IF QS="" THEN B=8
80 IF QS="8" THEN B=8
90 IF QS="14" THEN B=14
100 IF B=0 THEN 60
110 REM GET DRIVE NUMBER TO GET STANDARD BASIC FROM
120 PRINT
130 INPUT "DRIVE NUMBER FOR STANDARD BASIC: ",QS
140 IF QS="" THEN D1=1
150 IF QS="1" THEN D1=1
160 IF QS="2" THEN D1=2
170 IF QS="3" THEN D1=3
180 IF D1=0 THEN 130
190 REM GET DRIVE NUMBER TO PUT NEW BASIC ON
200 PRINT
210 INPUT "DRIVE NUMBER FOR RELOCATED BASIC: ",QS
220 IF QS="" THEN D2=1
230 IF QS="1" THEN D2=1
240 IF QS="2" THEN D2=2
250 IF QS="3" THEN D2=3
260 IF D2=0 THEN 210
270 REM GET STARTING ADDRESS FOR NEW BASIC
280 PRINT
290 INPUT "STARTING ADDRESS FOR RELOCATED BASIC(HEX): ",QS
300 IF QS="" THEN N1=10752 ELSE GOSUB 3700
310 IF N1>51712 THEN 290
320 N=N1
330 O=N-10752
340 REM GET ADDRESS FOR DOS USED FOR BASIC'S I/O
350 PRINT
360 INPUT "STARTING ADDRESS FOR DOS TO BE USED(HEX): ",QS
370 IF QS="" THEN N1=8192 ELSE GOSUB 3700
380 IF N1>60416 THEN 360
390 REM OPEN THE STANDARD BASIC FILE
400 IF B=8 THEN TS="BASIC," ELSE TS="BASIC14,"
410 TS=TS+CHR$(48+D1)
420 OPEN #0=N1,TS,L
430 REM GENERATE NAME BASED ON LOCATION OF NEW BASIC
440 T1=N
450 TS=""
460 FOR I=1 TO 4
470 T=INT(T1/16) (4-I))
480 T1=T1-16 (4-I)*T
490 IF T<10 THEN TS(I,1)=CHR$(48+T) ELSE TS(I,1)=CHR$(55+T)
500 NEXT I
510 IF B=8 THEN TS="B08-"+TS ELSE TS="B14-"+TS
520 TS=TS+","+CHR$(48+D2)
530 REM IF NEW BASIC FILE EXISTS, DESTROY AND MAKE NEW ONE
540 IF FILE(TS)<>-1 THEN DESTROY TS
550 CREATE TS,L,B
560 OPEN #1=N1,TS
570 REM INITIALIZE MEMORY POINTER
580 M=10752
590 REM RELOCATION SECTION - CALLS APPROPRIATE SUBROUTINES
600 REM FOR DIFFERENT SECTIONS
```


ly appear on the screen, signifying a software explosion.

The way around this, of course, is to change all the instructions that reference a memory location so that they reference a new location offset by a fixed amount from the original one. If you have a source program and an assembler, this can be done by simply changing the ORG statement at the beginning.

Unfortunately, with very few exceptions, nobody these days is interested in providing source listings for anything as complex as a BASIC or other high-level language. The reasons for this have been argued back and forth for years without resolution, but that's what we're stuck with for now.

So, if no source listing is available, what do you do? The answer is you create one. This is easier said than done for a language as long as BASIC where the source can easily run 4000-5000 lines. Still, we have to begin somewhere; since I have a home-brew disassembler that provides cross-referenced listings, that's just what I did.

Even though the above step seems to be a tough one, the most difficult part still remains: the examination and identification of each part of the program to see whether it consists of instructions or data. If the program consists of instructions, you must identify those instructions that reference memory locations that must be changed and those that ought to be left alone.

With program data there is a similar problem in that many tables contain a sequence of 2-byte addresses referencing the different locations where your favorite commands and functions live (READ, GOTO, SIN, etc.), whereas other data areas are only ASCII strings of error messages or floating point representations such as pi. The latter should be left alone, whereas the former need to have an offset applied to them so that they will run properly.

With this last bit of information, you can generate a new BASIC by simply applying the proper offset to the parts of the

program that need it. One way to do this is to somehow write the source listing to a disk file and then reassemble it.

However, knowing which areas need special treatment, you can bypass the assembly process and simply add the required offset where necessary. This can be done in machine language and would probably run the fastest that way, but it can also be done in BASIC using the file-accessing commands available to take a copy of standard BASIC located on a disk, process it a little at a time in memory and write the relocated BASIC to a new disk file. When you are finished, this new file can be run as BASIC at a new location in memory and use either the standard DOS or another DOS that can also be relocated using a similar procedure.

The Program

The program to relocate BASIC is really quite simple. It is also quite long because each time a break occurs in the type of code being relocated, a new value must be assigned to M1, and a call to a subroutine must be made. Loading and executing the program is direct and to the point. When the program is run, you will see that it asks for some information with prompts. Each time a prompt is printed you can type a carriage return, and the program will default to certain values. For the number of digits, the default is 8; for the disk drives, it is drive #1; for the starting address of BASIC, it is 2A00H; and for the DOS, it is 2000H.

I've tried to make it impossible (or at least difficult) to enter parameters that wouldn't make sense, but it pays to show a little caution anyway. Once the program begins running, you might as well go get yourself a cup of coffee—or an entire meal if desired. It takes about 30 minutes to churn through the file.

Certain prerequisites are necessary before running. The standard BASIC must be in a Type 1 file called "BASIC" for the 8-digit version, or "BASIC14" for the extended precision version. Also, the BASIC must be Release 4 for the program to work.

```
610 M1=10766
620 GOSUB 3930
630 M1=10769
640 GOSUB 4290
650 GOSUB 4350
660 GOSUB 4290
670 GOSUB 3930
680 M1=10777
690 GOSUB 4290
700 M1=10988
710 GOSUB 3880
720 M1=11256
730 GOSUB 3880
740 M1=11421
750 GOSUB 3930
760 M1=11707
770 GOSUB 4290
780 M1=12040
790 GOSUB 3880
800 M1=12118
810 GOSUB 3880
820 M1=12153
830 GOSUB 3880
840 M1=12199
850 GOSUB 3880
860 M1=12216
870 GOSUB 3880
880 M1=12278
890 GOSUB 3880
900 M1=12291
910 GOSUB 3880
920 M1=12311
930 GOSUB 3880
940 M1=12319
950 GOSUB 3880
960 M1=12324
970 GOSUB 3880
980 M1=12329
990 GOSUB 3880
1000 M1=12350
1010 GOSUB 3880
1020 M1=12390
1030 GOSUB 3880
1040 M1=12402
1050 GOSUB 3880
1060 M1=12437
1070 GOSUB 3880
1080 M1=12481
1090 GOSUB 3880
1100 M1=12496
1110 GOSUB 3880
1120 GOSUB 3900
1130 M1=12519
1140 GOSUB 3880
1150 M1=12565
1160 GOSUB 3880
1170 M1=12671
1180 GOSUB 3880
1190 M1=12814
1200 GOSUB 3880
1210 M1=13065
1220 GOSUB 3880
1230 M1=13098
1240 GOSUB 3880
1250 M1=13134
1260 GOSUB 3880
1270 M1=13278
1280 GOSUB 3880
1290 M1=13319
1300 GOSUB 3880
1310 M1=13387
1320 GOSUB 3880
1330 M1=13406
1340 GOSUB 3880
1350 M1=13434
1360 GOSUB 3880
1370 M1=13676
1380 GOSUB 3880
1390 M1=13747
1400 GOSUB 3880
1410 M1=13807
1420 GOSUB 3880
1430 M1=14027
1440 GOSUB 3880
1450 M1=14040
1460 GOSUB 3880
1470 M1=14103
1480 GOSUB 3880
1490 M1=14158
1500 GOSUB 3880
1510 M1=14656
1520 GOSUB 3930
1530 M1=14677
1540 GOSUB 4290
1550 M1=14825
1560 GOSUB 3930
1570 G=0
1580 GOSUB 3930
1590 G=0
1600 M1=15056
1610 GOSUB 3930
1620 IF B=14 THEN M=M-3
1630 M1=15109
1640 GOSUB 4290
1650 M1=15131
1660 GOSUB 4350
1670 O1=0
1680 O=N1-8192
```

```
1690 GOSUB 4350
1700 O=01
1710 M1=15205
1720 GOSUB 4350
1730 M1=15620
1740 GOSUB 4290
1750 FOR I=1 TO 8
1760 GOSUB 4290
1770 GOSUB 4350
1780 NEXT I
1790 M1=15648
1800 GOSUB 4290
1810 GOSUB 4350
1820 FOR I=1 TO 22
1830 GOSUB 4290
1840 GOSUB 4350
1850 NEXT I
1860 M1=15792
1870 GOSUB 3880
1880 M1=16061
1890 GOSUB 3880
1900 M1=16116
1910 GOSUB 3880
1920 M1=16131
1930 GOSUB 3880
1940 M1=16155
1950 GOSUB 3880
1960 M1=16178
1970 GOSUB 3930
1980 IF B=14 THEN M=M-12
1990 M1=16198
2000 GOSUB 4290
2010 M1=16300
2020 GOSUB 3930
2030 IF B=14 THEN M=M-6
2040 M1=16310
2050 GOSUB 4290
2060 M1=16446
2070 GOSUB 3880
2080 M1=16507
2090 GOSUB 3880
2100 M1=16514
2110 GOSUB 3930
2120 IF B=14 THEN M=M-3
2130 M1=16519
2140 GOSUB 4290
2150 M1=16538
2160 GOSUB 3880
2170 M1=16561
2180 GOSUB 3880
2190 M1=16672
2200 GOSUB 3880
2210 M1=16683
2220 GOSUB 3880
2230 M1=16696
2240 GOSUB 3880
2250 M1=16763
2260 GOSUB 3880
2270 M1=16795
2280 GOSUB 3880
2290 M1=16819
2300 GOSUB 3880
2310 M1=16828
2320 GOSUB 3880
2330 M1=16836
2340 GOSUB 3880
2350 M1=16882
2360 GOSUB 3880
2370 M1=16903
2380 GOSUB 3880
2390 M1=16959
2400 GOSUB 3880
2410 M1=16968
2420 GOSUB 3880
2430 M1=17253
2440 GOSUB 3880
2450 M1=17307
2460 GOSUB 3880
2470 M1=17381
2480 GOSUB 3880
2490 M1=17395
2500 GOSUB 3880
2510 M1=17419
2520 GOSUB 3880
2530 M1=17694
2540 GOSUB 3880
2550 M1=17744
2560 GOSUB 3880
2570 M1=17831
2580 GOSUB 3880
2590 M1=17855
2600 GOSUB 3880
2610 M1=17920
2620 GOSUB 3880
2630 M1=17933
2640 GOSUB 3880
2650 M1=18101
2660 GOSUB 3880
2670 M1=18105
2680 GOSUB 3880
2690 M1=18219
2700 GOSUB 3880
2710 M1=18237
2720 GOSUB 3930
2730 IF B=14 THEN M=M-3
2740 M1=18242
2750 GOSUB 4290
2760 M1=18327
```



```

2770 GOSUB 3880
2780 M1=18356
2790 GOSUB 3880
2800 M1=18422
2810 GOSUB 3880
2820 M1=18428
2830 GOSUB 3880
2840 M1=18434
2850 GOSUB 3880
2860 M1=18440
2870 GOSUB 3880
2880 M1=18446
2890 GOSUB 3880
2900 M1=18485
2910 GOSUB 3880
2920 M1=18838
2930 GOSUB 3880
2940 M1=18889
2950 GOSUB 3880
2960 M1=19157
2970 GOSUB 3880
2980 M1=19202
2990 GOSUB 3880
3000 M1=19528
3010 GOSUB 3880
3020 M1=19688
3030 GOSUB 3880
3040 M1=20183
3050 GOSUB 3880
3060 M1=20928
3070 GOSUB 3880
3080 M1=20972
3090 GOSUB 3880
3100 M1=21052
3110 GOSUB 3880
3120 M1=21115
3130 GOSUB 3880
3140 M1=21273
3150 GOSUB 3880
3160 M1=21311
3170 GOSUB 3880
3180 M1=21344
3190 GOSUB 3880
3200 M1=21412
3210 GOSUB 3880
3220 M1=21440
3230 GOSUB 3880
3240 M1=21472
3250 GOSUB 3880
3260 M1=21519
3270 GOSUB 3880
3280 M1=21560
3290 GOSUB 3880
3300 M1=21581
3310 GOSUB 3880
3320 M1=21604
3330 GOSUB 3880
3340 M1=21642
3350 GOSUB 3880
3360 M1=21657
3370 GOSUB 3880
3380 M1=21674
3390 GOSUB 3880
3400 M1=21688
3410 GOSUB 3880
3420 M1=21684
3430 GOSUB 3930
3440 IF B=14 THEN M=M-27
3450 M1=22450
3460 GOSUB 4290
3470 M1=22733
3480 GOSUB 3930
3490 IF B=14 THEN M=M-38
3500 M1=22783
3510 GOSUB 4290
3520 M1=22968
3530 GOSUB 3930
3540 IF B=14 THEN M=M-46
3550 M1=23018
3560 GOSUB 4290
3570 M1=23229
3580 GOSUB 3930
3590 IF B=14 THEN M=M-48

```

```

3600 M1=23269
3610 GOSUB 4290
3620 M1=23387
3630 GOSUB 3930
3640 IF B=14 THEN M=M-70
3650 M1=23552
3660 GOSUB 4290
3670 PRINT
3680 END
3690 REM SUBROUTINE TO CONVERT FROM HEX STRING TO DECIMAL
3700 N1=0
3710 FOR I=1 TO LEN(Q$)
3720 Q=ASC(Q$(I,1))-48
3730 IF Q>=0 AND Q<=9 THEN 3760
3740 Q=Q-7
3750 IF Q<10 OR Q>15 THEN N1=10000
3760 N1=16*N1+Q
3770 NEXT I
3780 RETURN
3790 REM SUBROUTINE TO HANDLE DOS REFERENCES
3800 GOSUB 3930
3810 O1=0
3820 O=N1-8192
3830 GOSUB 3930
3840 O=O1
3850 RETURN
3860 REM SUBROUTINE TO RELOCATE INSTRUCTIONS FOLLOWED BY A
3870 REM 3-BYTE FIXED INSTRUCTION
3880 GOSUB 3930
3890 REM SUBROUTINE TO HANDLE 3-BYTE FIXED INSTRUCTIONS
3900 Q$="H"
3910 GOTO 3940
3920 REM SUBROUTINE FOR NORMAL INSTRUCTIONS
3930 Q$="L"
3940 READ #0,&X
3950 WRITE #1,&X,NOENDMARK
3960 M=M+1
3970 REM FIND 3-BYTE INSTRUCTIONS
3980 IF X=195 OR X=205 THEN 4200
3990 IF X=1 OR X=17 OR X=33 OR X=49 THEN 4200
4000 IF X=34 OR X=42 OR X=50 OR X=58 THEN 4200
4010 IF X=194 OR X=196 OR X=202 OR X=204 THEN 4200
4020 IF X=210 OR X=212 OR X=218 OR X=220 THEN 4200
4030 IF X=226 OR X=228 OR X=234 OR X=236 THEN 4200
4040 IF X=242 OR X=244 OR X=250 OR X=252 THEN 4200
4050 REM FIND 2-BYTE INSTRUCTIONS
4060 IF X=211 OR X=219 THEN 4150
4070 IF X=6 OR X=14 OR X=22 OR X=30 THEN 4150
4080 IF X=38 OR X=46 OR X=54 OR X=62 THEN 4150
4090 IF X=198 OR X=206 OR X=214 OR X=222 THEN 4150
4100 IF X=230 OR X=238 OR X=246 OR X=254 THEN 4150
4110 REM ALL INSTRUCTIONS LEFT ARE 1 BYTE
4120 IF M<M1 THEN 3930
4130 RETURN
4140 REM 2-BYTE INSTRUCTIONS
4150 READ #0,&X
4160 WRITE #1,&X,NOENDMARK
4170 M=M+1
4180 GOTO 4120
4190 REM 3-BYTE INSTRUCTIONS
4200 READ #0,&Y,&X
4210 IF Q$="H" THEN 4250
4220 Y=256*X+Y+O
4230 X=INT(Y/256)
4240 Y=Y-256*X
4250 WRITE #1,&Y,&X,NOENDMARK
4260 M=M+2
4270 GOTO 4120
4280 REM SUBROUTINE TO HANDLE BYTE DATA
4290 READ #0,&X
4300 WRITE #1,&X,NOENDMARK
4310 M=M+1
4320 IF M<M1 THEN 4290
4330 RETURN
4340 REM SUBROUTINE TO HANDLE WORD DATA
4350 READ #0,&Y,&X
4360 Y=256*X+Y+O
4370 X=INT(Y/256)
4380 Y=Y-256*X
4390 WRITE #1,&Y,&X,NOENDMARK
4400 M=M+2
4410 IF M<M1 THEN 4350
4420 RETURN

```

The result of the program is a file of the same length as the standard version, and with a name that includes the starting address in it. The naming format is Bpp-xxxx, where pp is the number of digits of precision (8 or 14) and xxxx is the hexadecimal starting address.

After completion, you must assign the file a type of 1 and give it a go-address (which will, of course, be the same address

as that included in the name) from DOS; there just isn't any convenient way to assign a go-address from BASIC. Once this is done you're ready to test it by typing GO B08-3400 (for example). BASIC should load and give its READY prompt. You can then use MEMSET, if desired, to allow more space for your programs commensurate with how much memory you have available. Any programs written in

standard BASIC should be compatible with relocated versions of same.

Many people don't realize that programs written in the 8-digit version can be run in the 14-digit version and vice versa, but with a loss of precision. This does not hold true of data files, however, so don't try it for those.

Uses

I can think of several uses off-

hand. One is to create a version of BASIC that can be run at 3400H. The rationale behind this is that if while you're programming, you suddenly run out of disk space but have room on the lower disk tracks, you have to run COMPACT to open up some space on the disk. Unfortunately, when this happens it uses a scratch area of ten blocks immediately following the DOS to move files around. So, unless you have yet another disk with space on it to save your BASIC program while COMPACT writes all over the first part of BASIC, you're out of luck.

By putting BASIC at 3400H you can run COMPACT (or use the IN or DT commands in DOS) without disturbing BASIC or its program. Then you can reenter BASIC from DOS and save the program you've been working so hard on before it evaporates. Of course, you have to give up about 2.5K of memory in BASIC to do this, but these days memory seems to be becoming more plentiful and less expensive, and it need not be all that much of a problem.

Another application is to relocate both the DOS and BASIC to run at the beginning of memory, say with the DOS at 0000H and BASIC immediately thereafter (either with or without the ten-block scratch area in between). There are commercial programs available for moving the DOS, so I won't discuss it here—except to say you might want to try it yourself to keep you out of trouble on those rainy or snowy afternoons. With a setup like this, there's no more fiddling with DIP switches to change those memory board addresses when going from CP/M to North Star and back.

If you're really handy at patching, you can write some short routines to use the CP/M I/O drivers with North Star BASIC. The file-accessing patches are much harder, but possible. With just the I/O though, you can call BASIC as a CP/M COM file and at least write and run programs even if you can't save them. A version of BASIC relocated to 0100H is the heart of this particular application. ■

THE VERY BEST.



If you're serious about your TRS-80 computer, try these disk based programs. When it comes to hardware software, nobody does it like **TBS**.

BUSINESS MAIL SYSTEM by Dale Kubler is designed for large-scale business users. Requiring 32K, two disks and printer, this program will store up to 150,000 names in a single file spread out over multiple disks. Each data disk holds 500 names. After data entry, **BMS** automatically sorts the data by zip code and alphabetical order within the zip code. The program tells you when and which data disk to insert, expanding your files automatically until you've reached 300 disks. Data is input directly onto formatted screen display with the option to use Company Name/Attention instead of Last Name/First Name. Three numeric and one alpha code fields are provided to help you use the search and printout mode. **BUSINESS MAIL SYSTEM** allows you to program the number and spacing of your labels and then print out and read your data disks concurrently using accelerated printing. (This mode works only with Centronics printers.) With more features than can be described here, this high-powered program sells for \$125.00.

ANALYSIS PAD by Del Jones is the epitome of first-class programming in business applications. Requiring 48K, and one disk with a printer recommended, this columnar calculator gives the user tremendous flexibility in data entry enabling the user to create 30 or more columns and rows. Enter your own column and row labels. Enter your data by row or column or directly onto screen display via edit mode. Move, swap, delete, and add rows or columns. Create new pads by stripping relevant data from old files. You never have to key in data twice. But more important than the powerful data manipulation provided, you can add, subtract, multiply and divide one column by another and put results in another column. You can perform up to six calculations on one column and even define one column to be a constant. The calculation routine you create can be saved and reused. Print out the entire pad in four column segments to line or serial printer.

ANALYSIS PAD was originally advertised for 32K tape at \$32.50. Since then it has been totally rewritten and expanded to its present 48K disk only form and sells for \$49.50. It is easily worth twice as much. You have to see it to believe it.

DATA MANAGER by Dale Kubler starts out where **INFORMATION SYSTEM** leaves off. Requiring 32K and one disk, it accepts up to ten user-defined fields with up to forty characters per field and 255 characters per record. As with all TBS software, data entry and editing is professional and simple to use. What makes this program stand apart from "in-mem" data managers is that it uses up to four disks on line as memory, or as much as 320K of memory storage. Because disk sorts take more time than in-mem sorts, **DATA MANAGER** enables the user to create and maintain

up to 5 "key" sort files for quick access of data. A utility program is provided to calculate the number of records possible since the amount of records you can maintain is dependent on a number of variables. This program also supports the upper/lower case modification, and printouts can be programmed to almost any format and sent to line or serial printer. For Centronic printers, accelerated printing is provided enabling the computer to search and print at the same time. If you already have **INFORMATION SYSTEM**, **DATA MANAGER** will accept those files. (We are currently working on a program that will merge your data files with Electric Pencil files.) A necessity for organized people, this program sells for \$49.50.

CHECK REGISTER ACCOUNTING SYSTEM, adapted for the TRS-80 by Dale Kubler and originally written by O.E. Dial, is the most comprehensive check-balancing program written. Requiring 32K, two disks and printer, this program does much more than just balance and reconcile your checkbook. It enables you to define up to 60 account names and will generate monthly summaries of all accounts with monthly and year-to-date totals. Single-entry input allows the user to disperse one transaction over several accounts and to make a 64-character note on each transaction. Checks can be printed out after data has been entered. Aside from the Statement of Accounts, **CRAS** also generates the following reports: Check Register for any Month, Notes to Check Register, Income/Expense Distribution, Statement of Selected Accounts, Bank Reconcile Statement and Suspense File. The Suspense file is an extra feature where you can make notes to yourself for any month in the year. **CRAS** will make both you and your accountant happy and it sells for \$49.50.

TBS has other great software for your TRS-80. **BASIC TOOLKIT**, **SYSTEM DOCTOR** & **TERMINAL CONTROL** are system utilities. **CHECKBOOK II**, **INFORMATION SYSTEM** & **EXERCISER** are general applications. Don't forget the **LIBRARY 100**; 100 programs for only \$49.50. **TBS** also has **DISK HEAD CLEANERS** for **TRS-80** and **APPLE** and **GRAN MASTER DISKETTES**, the best on the market.

TBS is **YOUR COMPANY**, and to you we pledge to produce quality software at a price you can afford. The above products are available NOW at Computer Stores and Associate Radio Shack Stores nationwide or directly through us. For direct mail please include \$2.00 for postage and handling.

TBS TM ^{✓B33}
THE BOTTOM SHELF, INC.
 (404)939-6031 • P.O. Box 49104-K • Atlanta, GA 30359

Synertek's SYM-1: Still Versatile

The 'nym's new, but the SYM's still the same good old VIM.

About 1½ years ago, Synertek Systems Corp. (PO Box 552, Santa Clara CA 95052) introduced their Versatile Interface Module (VIM). It's now called the

SYM-1, but the versatile is still included. It uses a 6502 microprocessor that makes the SYM-1 a cousin of the KIM-1. The SYM-1 includes an excellent 4K

system monitor (in ROM), and the on-board 28-key keypad (along with a 6-digit hex format display) will get you started right away into machine-language

programming (see Fig. 1).

SYM-1 Features

Before going into more detail on the features of the system

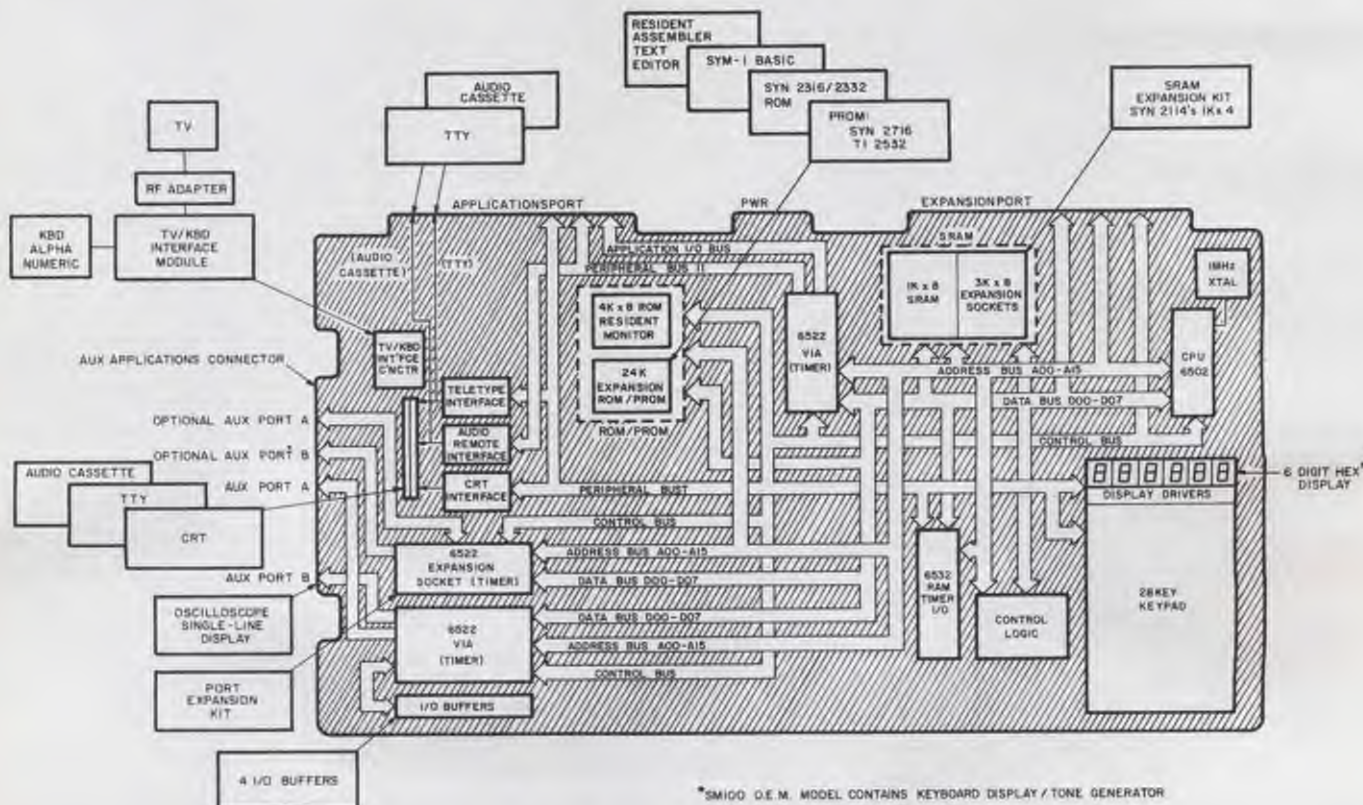


Fig. 1. Block diagram of the SYM-1 board (reprinted courtesy of Synertek Systems Corp.).

monitor, let me skim over some of the SYM-1's features. The board comes with 1K of 2114-type RAM and is expandable (on-board) to a healthy 4K worth of RAM. In addition to this, decoding is provided to add another 4K of RAM (off-board).

As mentioned before, the system monitor resides in ROM, but three sockets are provided to add up to 24K bytes of additional ROM/PROM. Addressing jumpers are provided so that each socket can accommodate any of four different types of read only memory devices.

On-board interfaces include a cassette interface complete with remote control (on/off of cassette recorder motor) that is usable in two modes: KIM-1 compatible and high speed (nearly 1500 baud). A Model 33 Teletype can be added through the 20 mA teleprinter interface, or if you'd rather use an RS-232 CRT terminal, an interface is provided for this also.

All of the software needed to support the cassette, Teletype and CRT terminal interfaces is included in the system monitor. In addition to this, the SYM-1 automatically adjusts for baud rates from 300-4800 baud (inclusive) when the CRT terminal interface is used. For users without terminals, the SYM-1 provides an oscilloscope driver that will allow you to use an ordinary oscilloscope to display one line of 32 characters; the software for this scope driver is included in the SYM-1 reference manual.

For input/output and timing applications, the board comes with two 6522 VIAs (versatile interface adapter) and one 6532 device. These three devices are worthy of a chapter by themselves; they are one of the big reasons the SYM-1 is so versatile. The 6532 has an on-chip programmable interval timer; its I/O ports are used to interface the keypad/display or any other user-supplied terminal to the microprocessor.

The 6522 devices include two on-chip timers—an interval timer (that can double as a "pulse counter") and a timer that can operate either in a free-running mode or in the "interval" mode. The 6522s also

include two 8-bit bidirectional I/O ports (with "handshake" capability) that can be configured in any I/O combination through the 6522's Data Direction registers. In fact, some of the features of the SYM-1 (such as the scope driver, cassette interface and the write protection of user RAM) use part of these VIAs.

If this I/O capability is not enough for you, a socket is provided so you can add one more 6522 to the SYM-1 to give you 16 additional I/O lines (with handshaking lines), plus the timers and other on-chip functions. Four buffers are also provided on-board (on four I/O pins of VIA #3) that the user can configure in any way he chooses.

And there's one nice thing about the SYM-1 that I've saved for now: It's already assembled and fully tested; all you add is a single +5 V supply.

System Monitor

I left the discussion of the system monitor for now because if you bought a microcomputer to learn about it and its microprocessor (as I did), then you'll want an operating system that's versatile and thorough enough to allow you debugging facilities and to give you the ability to examine registers, move data around and so on. It would take too much space to describe each of the system commands, so here is just a list: Memory Examine/Modify, Memory Search, Register Examine/Modify, Go (to start the program at immediate address or address given), Verify (display eight bytes in memory or any number of bytes), Deposit To Memory, Calculate (for hexadecimal arithmetic), Move Memory Block (to another location), Jump, Store Double Byte, Fill Memory Locations X-Y With Z, Write Protect (user RAM), Load Tape (KIM-1 or high-speed), Load Paper Tape, Save Paper Tape, Save Tape (KIM-1 or high-speed) and Execute.

In addition to these commands, "+" advances eight bytes (as when in Memory Examine), "-" retreats eight bytes, "→" advances one byte



The SYM-1 package.

(or register) and "←" retreats one byte. There are eight user-defined keys to enable you to add to the monitor's command repertoire, and there is a system reset key to allow you to sweep your mistakes under the rug. And, of course, there is the DEBUG key/function.

Pressing DEBUG allows you to single-step through each instruction in your program. Thus, after each instruction is executed, you can examine all of the registers and any memory locations and then go on to the next instruction in your program by pressing GO and Carriage Return (CR).

You can let the monitor step through your program, but at a rate that's closer to jogging rather than mile-a-minute sprinting. By changing the "Trace" velocity, you can set up the monitor to display the Program Counter address and the contents of the accumulator, pause and then resume execution, again one instruction at a time. And there is even a set of error messages to tell you when something is wrong (I still like the Bronx cheer method better).

The error codes are interactive; that is, the error message flashed onto SYM-1's display depends on the context in which the error occurred. This simplifies to a message of "Er XX," where XX is a two-digit representation of the byte that couldn't be digested. Finally, for you programmers, the eight user-defined keys should start

you on your way to controlling the world.

Unfortunately, I've had to restrict (and sometimes omit) the descriptions of the SYM-1's features and capabilities. For more detail consult the comprehensive manuals that come with the board.

Applications

With its I/O and timing capabilities, the SYM-1 is an obvious choice for intelligent-controller-type applications. But the board is an application in itself, teaching you machine-language programming and the merits of the 6502 microprocessor, including the versatile combination of its instruction set and addressing capabilities. You can apply what you learn to all microprocessor-based computers, as all microprocessors share common features that will enable even a novice to get his or her foot in the door.

For those interested in programming in a high-level language, there is Synertek's BASIC, which is packaged in two ROMs that plug right into sockets provided on the SYM-1. This extended BASIC even has string functions that should enable you to write a nice text editor or two.

But it is the SYM-1's ability to interface with the real world that will please the utility-minded user most. If he is a photographer, the SYM-1 can automate his darkroom from enlarger timing to agitation of the chem-

icals; if he is interested in an audiovisual display, he can control lighting systems to the tune of his favorite music, creating effects that will make ordinary color-organs pale in comparison.

To an experimenter/hobbyist, the SYM-1 could combine several test instruments into one, such as a frequency counter, digital voltmeter and a programmable pulse generator; for the electronic music enthusiast, the SYM-1 could

become the heart of a polyphonic synthesizer, generating envelopes for your VCAs (voltage controlled amplifier) and even making sure you're in tune.

You can write programs that will test ICs (with the addition of some wire and a zero insertion force socket or two), program your EPROMs (and check for errors), move "light" pieces on a game board, secure your home; in short, anything that can be controlled electrically (directly

or indirectly) can most probably be controlled and monitored by SYM-1. That includes the coffee-pot.

My own uses for SYM-1 have included some of the above (such as the EPROM programmer) plus such things as a geometric art generator that uses an ordinary oscilloscope, and a music program that will play up to 256 notes (any audible frequency) and uses the on-board timers (in the VIAs) for the notes' pitch and duration. When I got

the Synertek BASIC, I wrote some "recreational" programs including a conversational program, and even a program that will balance a checkbook.

So, if you like to program in BASIC, or are interested in using a microcomputer as the intelligent heart of any system (from kitchens to multi-channel data-acquisition systems), or if you're just interested in learning about microprocessors and microcomputers, look into the SYM-1. ■

TRS-80 SOFTWARE TRS-80

Aardvark games are now available for the TRS-80, Level II.

REAL TIME

Starfighter.....\$5.95
A real time space mission featuring 4 types of opponents, working instruments, 3 types of weapons, and 10 levels of difficulty.

Slashball.....\$5.95
Once a machine code favorite, it's now available in BASIC. It takes fast reflexes and planning to score.

Breakthru.....\$5.95
This fast action, pinball-like game features user selectable bumpers.

FOR THINKERS

Battlefleet.....\$5.95
This one is Battleship all grown up for adults. A tough thinker's game that you play against the computer.

All programs come on cassette with listings and documentation.

Send \$25 or SASE
for descriptions.

**AARDVARK
TECHNICAL
SERVICES**
1090 BOLTON, WALLED LAKE
MI 48088 313-624-6318



TRS - 80

SPEEDUP MOD

REVERSE VIDEO



Install a Speedup Board and run your Level II TRS-80 50% faster. Simple "Out" statement changes between normal and faster 2.66 mhz operation. No switch required — no program crashes.

A switch (not supplied) may be added for manual control.

ASSEMBLED \$24.95 Kit \$18.95

REVERSE VIDEO without switches or software. It provides black characters and graphics on a white screen for a crisper presentation. Change between normal and reverse by simultaneously pressing a combination of three keys on the keyboard.

ASSEMBLED \$14.95

California residents add 6% sales tax
For shipments outside of USA add 15%.

Bill Archbold Electronics
Dept KB, P.O. Box 7123, Sacramento, CA 95826
(916) 362-3627

MEMOREX Floppy Discs

Lowest prices. **WE WILL NOT BE UNDERSOLD!** Buy any quantity 1-1000. Visa, Mastercharge accepted. Call free (800)235-4137 for prices and information. All orders sent postage paid.



**PACIFIC
EXCHANGES**
100 Foothill Blvd.
San Luis Obispo, CA
93401. (In Cal. call
(805) 543-1037.)

✓ P66

SBASIC

NEW revision 4.0 of SBASIC. All the features of SBASIC (case structure, procedures, etc.) plus LINK statement to copy external source files at compile time, multiple statements per line, and more. Compile time performance has been improved by 50 percent. Available on CP/M* disk and TRS-80* diskette for \$50, listing \$35, manual \$10.

**ULTIMATE COMPUTER
SYSTEMS**

313 Meadow Lane
Hastings, Michigan 49058
(616) 945-5334

(Dealer inquiries invited)

*CP/M and TRS-80 are trademarks of Digital Research and Tandy Corp. ✓ U12

CASSETTE DUPLICATION

TRS-80 (I & II), PET, APPLE, KIM, ATARI

Quality software duplication is more than copying cassettes. Microsette duplication uses a proprietary high speed duplicator designed specifically for computer program duplication. The finished products are of consistent quality, guaranteed to load. Minimum order is 100 with discounts for higher quantities. Call (408) 735-8832 for details.



MICROSETTE CO.
777 Palomar Avenue
Sunnyvale, CA 94086

Canadian 8K MEMORY KITS

M1—Fast Signetics 21L02-1 RAMs with 20 pages of Documentation—solder mask Low power Schottky—S-100 Bus—Full Buffering
\$179.95

M2—as above with DIP switch address select and Robinson Nugent IC sockets only **\$199.95**

MEM1—WAMECO bare board as used in above kits **\$39.95**

Write for info on WAMECO CPU and other S-100 bare boards.

ORTHON COMPUTER
(ORTHON HOLDINGS LTD.)

✓ D8

12411 Stony Plain Rd
Edmonton, Alberta Canada T5N3N3

We have acquired the rights to all TDL software (& hardware). TDL software has long had the reputation of being the best in the industry. Computer Design Labs will continue to maintain, evolve and add to this superior line of quality software.

— Carl Galletti and Roger Amidon, owners.

All of the software below is available on any of the following media for operation with a Z80 CPU using the CP/M* or similar type disk operating system (such as our own TPM*).

for TRS-80* CP/M (Model One)
for 8" CP/M (soft sectored single density)
for 5 1/4" CP/M (soft sectored single density)
for 5 1/4" North Star CP/M (single density)
for 5 1/4" North Star CP/M (double density)

BASIC I

A powerful and fast Z80 Basic interpreter with EDIT, RENUMBER, TRACE, PRINT USING, assembly language subroutine CALL, LOADGO for "chaining", COPY to move text, EXCHANGE, KILL, LINE INPUT, error intercept, sequential file handling in both ASCII and binary formats, and much, much more. It runs in a little over 12 K and is ROMable. An excellent choice for games since the precision was limited to 7 digits in order to make it one of the fastest around. \$69.95.

BASIC II

Basic I but with 12 digit precision to make its power available to the business world with only a slight sacrifice in speed. Still runs faster than most other Basics (even those with much less precision). \$99.95

BUSINESS BASIC

The most powerful Basic for business applications. It adds to Basic II with random or sequential disk files in either fixed or variable record lengths, simultaneous access to multiple disk files, PRIVACY command to prohibit user access to source code, global editing, added math functions, and disk file maintenance capability without leaving Basic (list, rename, or delete). \$159.95.

ZEDIT

A character oriented text editor with 26 commands and "macro" capability for stringing multiple commands together. Included are bidirectional search with optional replace and a complete array of character move, add, delete, and display functions. \$49.95.

ZTEL

Z80 Text Editing Language - Not just a text editor. Actually a language which allows you to edit text and also write, save, and recall programs which manipulate text. Commands include conditional branching, subroutine calls, iteration, block move, expression evaluation, and much more. Contains 36 value registers and 10 text registers. Be creative! Manipulate text with commands you write using Ztel. \$68.95.

TOP

A Z80 Text Output Processor which will do text formatting for manuals, documents, and other word processing jobs. Works with any text editor. Does justification, page numbering and headings, spacing, centering, and much more! \$68.95

*Z80 is a trademark of Zilog

*TRS-80 is a trademark of Radio Shack

MACRO I

A macro assembler which will generate relocatable or absolute code for the 8080 or Z80 using standard Intel mnemonics plus TDL/Z80 extensions. Functions include 14 conditionals, 16 listing controls, 54 pseudo-ops, 11 arithmetic/logical operations, local and global symbols, chaining files, linking capability with optional linker, and recursive / reiterative macros. This assembler is so powerful you'll think it is doing all the work for you. It actually makes assembly language programming much less of an effort and more creative. \$49.95

MACRO II

Expands upon Macro I's linking capability (which is useful but somewhat limited) thereby being able to take full advantage of the optional Linker. Also a time and date function has been added and the listing capability improved. \$68.95

LINKER

How many times have you written the same subroutine in each new program? Top notch professional programmers compile a library of these subroutines and use a Linker to tie them together at assembly time. Development time is thus drastically reduced and becomes comparable to writing in a high level language but with all the speed of assembly language. So, get the new CDL Linker and start writing programs in a fraction of the time it took before. Linker is compatible with Macro I & II as well as TDL/Xitan assemblers version 2.0 or later. \$68.95

DEBUG I

Many programmers give up on writing in assembly language even though they know their programs would be faster and more powerful. To them assembly language seems difficult to understand and follow, as well as being a nightmare to debug. Well, not with proper tools like Debug I. With Debug I you can easily follow the flow of any Z80 or 8080 program. Trace the program one step at a time or 10 steps or whatever you like. At each step you will be able to see the instruction executed and what it did. If desired, modifications can then be made before continuing. It's all under your control. You can even skip displaying a subroutine call and up to seven breakpoints can be set during execution. Use of Debug I can pay for itself many times over by saving you valuable debugging time. \$69.95.

DEBUG II

This is an expanded debugger which has all of the features of Debug I plus many more. You can "trap" (i.e. trace a program until a set of register, flag, and/or memory conditions occur). Also, instructions may be entered and executed immediately. This makes it easy to learn new instructions by examining registers/memory before and after. And a RADIX function allows changing between ASCII, binary, decimal, hex, octal, signed decimal, or split octal. All

TPM is a trademark of Computer Design Labs. It is not CP/M

*CP/M is a trademark of Digital Research

these features and more add up to give you a very powerful development tool. Both Debug I and II must run on a Z80 but will debug both Z80 and 8080 code. \$88.95.

ZAPPLE

A Z80 executive and debug monitor. Capable of search, ASCII put and display, read and write to I/O ports, hex math, breakpoint, execute, move, fill, display, read and write in Intel or binary format tape, and more! Disk \$19.95. Also available in 2Kx8 ROM with initialization for the SMB I or II (3 ACIA's and 1 PIA) \$34.95.

SMB II bare board \$49.95.

One PIA and four 74LS244's for SMB II \$12.95

8080 version of Zapple - disk \$19.95
on 2516 \$49.95

TPM*

A NEW Z80 disk operation system! This is not CP/M*. It's better! You can still run any program which runs with CP/M* but unlike CP/M* this operating system was written specifically for the Z80* and takes full advantage of its extra powerful instruction set. In other words its not warmed over 8080 code! Available for TRS-80*, Tarbell, ICOM, Xitan DDDC, SD Sales "VERSA-FLOPPY", North Star (SD&DD), and Digital (Micro) Systems. \$49.95.

PAYROLL

The Osborne package. Requires C Basic 2 2 disks \$74.95 Book \$15.00

ACCTS REC/ACCTS PAY

By Osborne. Requires C Basic 2 \$99.95 Book \$15.00.

GENERAL LEDGER

By Osborne. Requires C Basic 2 \$99.95 Book \$15.00

C BASIC 2

Required for Osborne software \$99.95 Manual included.

ORDERING INFORMATION

Visa, Master Charge and C.O.D. O.K. To order call or write with the following information.

1. Name of Product (e.g. Macro I)
2. Media (e.g. 8" CP/M)
3. Price and method of payment (e.g. C.O.D.) include credit card info. if applicable.
4. Name, Address and Phone number.
5. For TPM orders only: Indicate if for TRS 80, Tarbell, Xitan DDDC, SD Sales (5 1/4" or 8"), ICOM (5 1/4" or 8"), North Star (single or double density) or Digital (Micro) Systems.
6. N.J. residents add 5% sales tax.

For Phone orders only call toll free
1-800-327-9191 Ext. 676

(Except Florida)

1-800-432-7999 Ext. 676 (Florida)

Computer Design Labs

342 Columbus Avenue
Trenton, N.J. 08629

Dealer inquiries invited.

✓ C156



For tech calls: United Software Applications 609-599-2146 or Otto Electronics 609-448-9165

Converting Selectric Keyboards from BCD to Correspondence Code

Part 2 of this article plugs into the electrical aspects of converting BCD Selectrics.

Robert M. Weil
1700 Security Pacific Plaza
1200 3rd Ave.
San Diego CA 92101

The electrical part of the modification consists of rewiring the contacts in the machine to bring out the additional character selection information made possible by use of the Correspondence code. There are three sets of transmitting contacts. One set of seven pairs is operated by the selector bails to reproduce the six-bit plus parity character selection code. A second set consists of five pairs operated by the five machine control, or operational, keys. Finally, a set of shift transmit contacts senses whether the mechanism is being shifted, and whether to uppercase or lowercase.

To generate codes for a full character set, the shift information must be stored and used as a seventh character selection bit, doubling the number of possible code combinations.

The use of the character selection contacts is completely straightforward. The code from the interposers is reproduced as contact closures and may be directly connected to logic outside the machine. Application of the operational and shift contacts requires some explanation, however.

Operational and Shift Contacts

First, consider the operational contacts. There is a contact pair corresponding to each operational function, which produces an inefficient 1-out-of-5 code. My original intention was to convert this into binary form and to combine the encoded operational information with the character selection code so that both character and control codes would appear on the same output connections, as is the case with ASCII-coded devices. After considerable investigation, I concluded that a simpler, more widely usable modification would result if the machine were simply rewired to IBM's standard for Correspondence-coded Selectric I/O's.

Their approach is to just bring the individual operational contacts out to the connector. This has two advantages. First, it is easy to do. Second, it allows the user to choose either a hardware or a software method of code conversion. A parallel input port could be used to monitor the status of the operational contacts, with a brief lookup table provided to translate contact closures into ASCII control codes. Hardware methods would be more elaborate. An interface with hardware code conversion and handshaking is in the planning

stages, and might be the subject of a future article.

The shift transmit contacts, like the operational contacts, would be combined in some manner with the character selection contacts if we intended to put the complete code on a limited number of output lines. As in the case of the operational contacts, I decided instead to do it IBM's way and bring them out individually to the connector.

In BCD machines, because there are fewer codes, IBM found it convenient to take the opposite approach, combining operational codes with character codes. This was done by recoding the operational and shift contact closures into binary form using diodes and connecting them to the character selection contacts.

To complete modification to Correspondence code, this interconnecting wiring and the diodes must be removed. Modifying the wiring is simplified somewhat by IBM's use of taper pins, replaceable connector pins and, on some models, wire-wrap clips for making connections. What follows is a detailed description of the rewiring required.

Rewiring

Fig. 1 is the schematic of a BCD machine. Note the manner in which the character selection and operational contacts are interconnected. Fig. 2 is a complete schematic of Correspondence-coded I/O wiring. Figs. 1 and 2 are all-inclusive; IBM states that there are probably no machines that include all the features shown. My machine did not include a shift magnet or shift mode contacts, though it had shift transmit contacts and a set called C3, which, like shift mode, is a part of the printer handshake for shifting.

In both the Correspondence and BCD versions, the six code bits and the parity bit are brought out to pins r, s, t, u, v, w and x of the 50-pin connector. (If you have one of the few 34-pin units, an unofficial schematic is available from the author. Send a stamped, self-addressed envelope.) The circles marked with a lowercase letter and a number refer to terminals on the taper pin blocks.

Fig. 3a shows the layout of a typical taper pin block; Fig. 3b shows where the blocks are located. Note that the operational and shift mode contacts do

Qty.	Part No.		Price
6	2122258	Male pin (for 50-pin connector)	.80
10	4187243	Taper terminal (also 0187243)	.02
10	1166039	Slip terminal (wire-wrap clip)	.03

Parts list.

Connector Pin	Remove From	Connect To
r	a3	a2
s	a2	a4
t	a6	a6 (no change)
u	a4	a8
v	b3	b2
w	b5	b4
x	b6	b7

Table 1.

A list of the parts you will need is included in the article. Tools required are a soldering iron, needle-nose pliers, cutters, wire-strippers, a small and a medium screwdriver and a solder wick or solder-sucker. Take a good look at the underside of your Selectric, and locate the features shown in Fig. 3b. Now you are ready to begin.

1. Locate the character selection contact assembly. It is halfway back on the left, under a clear plastic cover.

2. Remove the plastic cover. Replace the two screws. They will serve as guides for dressing wires to clear the cover.

3. Examine the configuration of the contacts. Notice that they are arranged in seven groups, each consisting of four single-pole, double-throw sets. This modification involves only those farthest from the frame. Those closest to the frame are wired to form a parity tree. You will not use it, but it is unnecessary to spend time removing the wiring.

4. Unsolder all the wiring from the lower contacts. Included will be one jumper to the right-hand upper set, which should be unsoldered at both ends.

5. Using a needle-nose pliers, disconnect all diodes from the taper pin blocks. Taper pins can be disconnected by a sharp pull straight out from the block.

6. After removal of the diodes, there will be seven taper pins left with hookup wire attached which was previously unsoldered during step 4. Relocate these in the following positions: a2, a4, a6, a8, b2, b4,

b7. Move the two pins already in b7 to b8. If there was already a pin in a2, remove it and tie it back.

7. Refer to Fig. 4. Install a

piece of bus wire, tying together all the center contacts of the lower set, and connect it to the right hand upper set as shown. Loop the wire so that it clears

the cover screws by 1/8 inch or more.

8. Connect the seven jumpers referred to in step 6 as shown in Fig. 4.



9. Relocate the wires that run from the connector to the taper pin blocks as shown in

Table 1.

10. Any taper pins not disposed of in steps 6 and 9 are

part of the interconnect from the operational and shift contacts. Disconnect them. If you

are accustomed to working with either lacing cord or cable ties, the main harness may be unlaced between blocks A and B and the operational contacts, and the unnecessary wires removed. If this seems too difficult, they may be tied back to the harness. In either case, double-check that you haven't removed a necessary wire. This completes the rewiring of the character selection contacts.

11. Looking at the bottom of the machine, locate the operational contact assembly at the lower right. The earliest models had leaf-type contacts with soldered connections. The vast majority had a molded contact housing with wire-wrap pins protruding from the bottom.

12. Strip all wiring from the operational contacts. Locate and mark the wire that comes from the normally open contact of the C5 set. The C5 and C6 contacts are above the frame at the rear of the mechanism, with the C5 set closest to the motor. Double-check that C5's normally open contact is connected to pin b of the connector.

13. Make a "daisy chain" of wire-wrap clips with about 1 inch of hookup wire between them. Slip the clips over pin J of each set of contacts. Refer to Fig. 5.

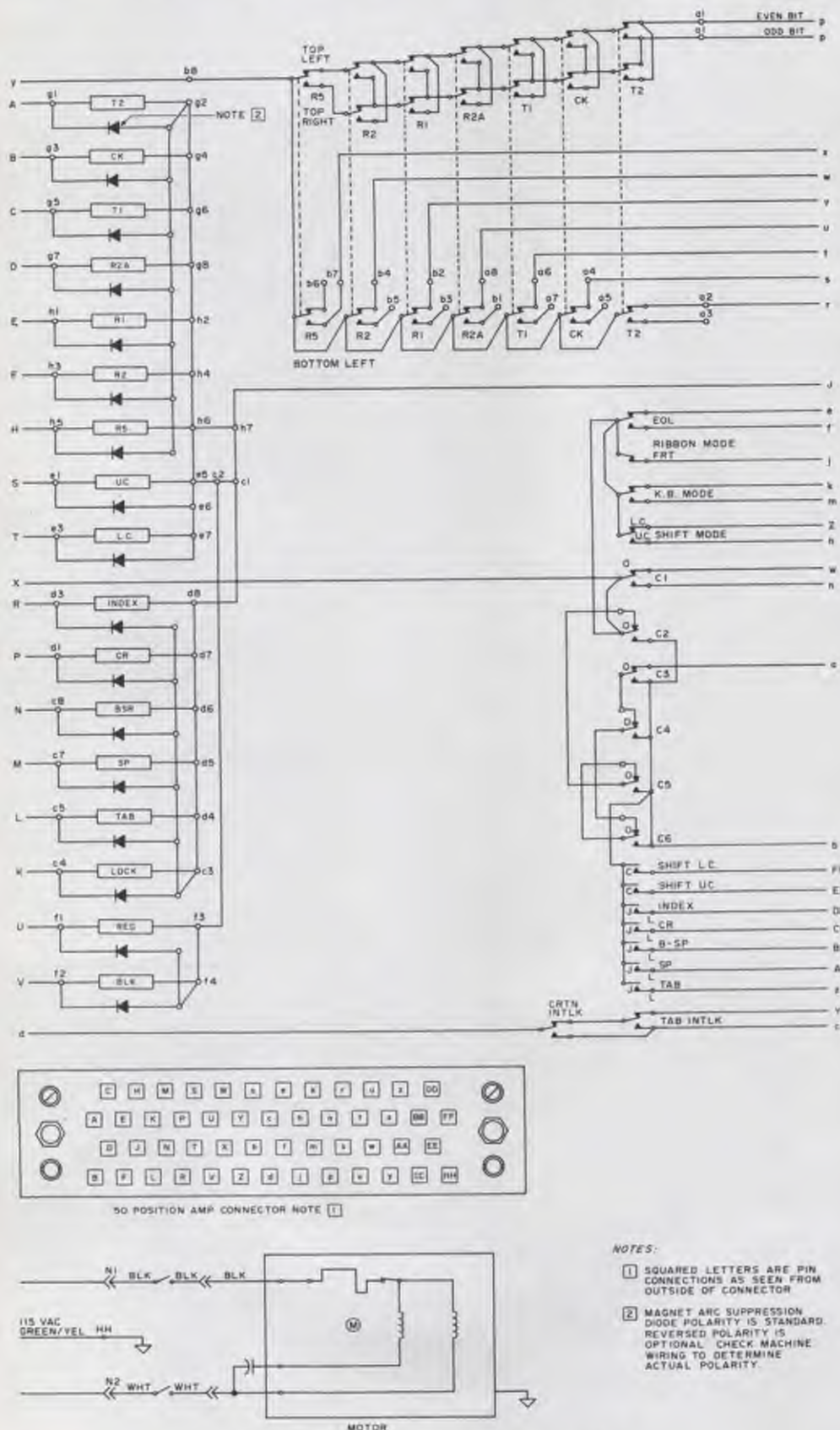
14. Connect the previously identified wire from pin b onto any of the "J" pins.

15. Measure the length of wire required to reach from the operational contact assembly, pin L, to the connector.

16. Prepare five jumpers of the appropriate length, each with a male connector pin on one end and a wire-wrap clip on the other end.

17. Snap a connector pin into position z of the connector. Slip the wire-wrap clip over pin J of the tab contacts. In the same manner, connect pin AA to space, pin BB to back space, CC to return and DD to index.

18. Locate the shift transmit contacts. Do this by switching on your machine and looking at its right side. Shift to upper-case, then back to lowercase. Note that on the end of a shaft there is a round assembly that rotates during a shift but is sta-



tionary otherwise. This is called the *shift clutch*. Below and to the rear of the shift clutch are some contacts. Note that they move during a shift. The rearward group consists of three sets of single-pole, double-throw contacts. These are the shift transmit contacts. Note



Fig. 3a. A typical taper pin block. The three connections under each number are connected together internally.

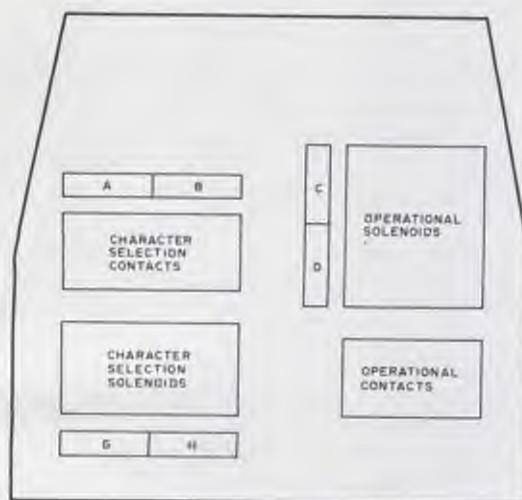


Fig. 3b. Locations of contact assemblies and taper pin blocks on bottom of machine.

that there is a common connection to the swinging contacts of all three pairs.

19. Disconnect and tie back or remove all the wires connected to the shift transmit contacts.

20. Measure the length required to reach from the shift transmit common to one of the "J" pins on the operational contact assembly. Prepare a jumper with a wire-wrap clip at one end. Solder it to the shift transmit swinging contact common, and connect the other end to one of the "J" pins.

21. Measure the length required to reach from the shift transmit stationary contacts to the 50-pin connector. Prepare

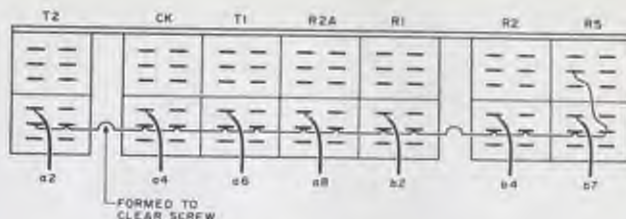


Fig. 4. Character selection contacts.

two jumpers, each with a connector pin at one end.

22. Connect one jumper to an inboard (toward the frame) stationary contact. Snap the connector pin into position EE of the connector. Connect the other jumper to an outboard stationary contact. Snap its connector pin into position FF of the connector.

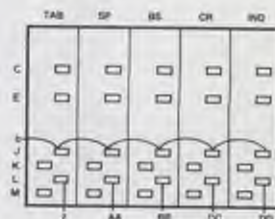


Fig. 5. Wire-wrap pins on operational contact assembly.

Modification Complete

This completes the modification. You are now the owner of a Correspondence-coded Selectric I/O typewriter. It will serve as a top-quality typewriter using any Correspondence typeball, and the electrical output of the keyboard is now Correspondence coded. You may take either of two approaches to interfacing the machine with your computer. It can be done entirely by using software, by

providing code conversion lookup tables in memory. If a hardware approach appeals to you, there is a code conversion IC, from ASCII to Selectric and from Selectric to ASCII, available at a reasonable price (MCM6561, available from Tri-Tek, Inc.). Whichever method you use, this modification will transform your Selectric I/O from a printer with a useless keyboard into a fully functional hard-copy terminal. ■

IBM No. 241-5737-0
241-5990-0
241-5188-9

Service Manual \$7.85
Adjustment Parts Manual 4.10
Part Number/Price List .45

Recommended reading.

TRS-80™

SUPERMAP

NEED HELP WITH TRS-80 MACHINE LANGUAGE ?

SUPERMAP TO THE RESCUE!

SUPERMAP contains hundreds and hundreds of comments and explanations arranged in a long detailed memory map. Documents keyboard, video, tape, LEVEL II commands and functions. SUPERMAP even reveals the mysterious reserved RAM areas. An essential tool for the expert and a valuable guide for the beginner.

NEVER BE LOST AGAIN WITH SUPERMAP...only \$10.95

PULLER SOFTWARE
630 E. SPRINGDALE
GRAND PRAIRIE, TEXAS 75051 ✓F20

Note: Texas residents add 9% for sales tax.

THE SMART TERMINAL

SOFTWARE PACKAGE FOR THE TRS-80

- TRUE BREAK KEY
- AUTO REPEAT KEYS
- PROGRAMMABLE 'SOFT' KEYS
- MULTIPAGE SCROLLING DISPLAY
- FULLY CONFIGURED FROM KEYBOARD
- TWO SELECTABLE LINE DIAGNOSTIC MODES DISPLAY CONTROL CHARACTERS
- MULTI PROTOCOL CAPABILITY
- GRAPHIC CHARACTERS GENERATED FROM KEYBOARD
- TRANSMIT SCREEN, PRINT SCREEN
- TRANSMIT FILE, RECEIVE & CREATE DISK FILE
- FLEXIBLE I/O LINKAGE CAPABILITY
- DISPLAY AND KEYBOARD DRIVERS CAN BE USED UNDER DOS

\$79.95

MICRON, INC.

10045 Waterford Dr.
Ellicott City, MD 21043
(301) 461-2721
MC/ISA accepted ✓M115

Now Available: **SPOOL-80**
Print your listings while running other programs (disk systems only) **39.95**

Advanced Scientific Software for

TRS-80 and NORTH STAR

MATH Library I

22 quality programs (req. 16K) including root of equations, integration, differentiation, simultaneous equations, matrix operations, interpolations, regression analysis (linear, polynomial, multiple), ordinary differential equations, partial differential equations, statistics and plotting; with manual.

TRS-80 disk \$35
TRS-80, Level II tape \$32
North Star disk (single density) \$45

ODE Master

Solves single and simultaneous ordinary differential equations; can handle even 'stiff' problems; error control and formatted output to CRT or printer; with manual.

TRS-80 Level II, 16K tape \$25
North Star disk (single density) \$30

Custom Software for education or professional use is available.

Dr. Lee ✓L3

5819 Thomas Ave., Philadelphia PA 19143 (215) 748-4558

Plucking Programs from Thin Air

Amateur radioteletype transmissions are an unusual source of new programs. Eavesdropping can be easy with a properly programmed 6800.

John J. Glidewell
3623 Charlene Dr.
Dayton OH 45432

Programs from thin air? Yes. By radioteletype. Radioteletype (RTTY) is used by many amateur radio operators (hams) to exchange messages and other types of data. Such transmissions are usually printed on a regular Teletype machine or on a video display. Many hams are also computer hobbyists, and program exchange by RTTY has become quite common.

Although you must be a licensed ham to transmit programs, anyone can receive them. Long-range transmissions use high-frequency (HF) radio, but two-meter FM radio (144.5-148 MHz) is being used more frequently for exchange of programs within the local area. Reception of these transmissions is the subject of this article.

Radioteletype

RTTY is accomplished by using two audio tones in exactly the same manner as is done by many computer tape systems. The common standard defines a mark as 2125 Hz and a space as either 2295 Hz (narrow shift)

or 2975 Hz (wide shift). Narrow shift is normally used on the long-range HF bands, while wide shift is more common on the VHF bands. However, narrow shift is used locally on two-meter FM; therefore, the listed program will operate with either.

The various means by which transmission is accomplished are not germane to the immediate problem; however, a brief description of how RTTY reception and detection is accomplished is needed.

Output of a receiver tuned to an RTTY signal is the pair of audio tones. The tones are fed into a device called a terminal unit, or TU for short. The TU may contain amplifiers and limiters and a pair of narrow bandwidth audio filters, one tuned to each of the two audio tones.

The filters provide noise rejection and detection of the signal as either a mark or space. The output of the filters actuates a relay or some form of SPDT switch, one position of which represents the mark and the other position the space. The switch controls a standard 60 or 20 mA current loop to drive the printer directly. Thus, the TU acts like a computer I/O device and could replace a key-

board or other input device to enter data directly into the computer.

On the noisy HF bands, a fairly high-quality receiver and TU are needed for good performance. However, operation on the two-meter FM band has a couple of advantages. First, unlike most HF operations, the mark and space tones modulate the transmitter in such a manner that they will be reproduced correctly by the receiver even though it may be slightly off frequency, provided only that the signal remains within the passband of the receiver. Therefore, the highly stable receiver required on the HF bands is not mandatory with FM; although, of course, the better the receiver, the better the performance.

Second, FM reception is much more free of noise as long as a reasonable signal is received. These two items permit the elimination of the expensive TU and permit decoding of the mark-space tones to be done in software. The I/O interface device described here is simple and inexpensive, so the only item of any expense required for two-meter FM RTTY reception is a receiver, and you may already have a suitable

one (more on that later).

At the time this is being written, amateur RTTY is restricted by the FCC to five-level Baudot code. I hope that ASCII will be approved soon since it is a far more satisfactory code for computer use. When ASCII is approved, I have a similar program all tested and ready to go. In the meantime, Baudot is the thing.

Even when ASCII is approved, I believe Baudot will still be extensively used because of the tremendous investment in terminal equipment. Even if the switch is made to ASCII for program transmission, there will still be a lot of interesting things going on in Baudot, one of which is called RTTY art in which pictures are transmitted. Last season I copied many nice Christmas pictures and posters using the program described.

Baudot in Miniature

Baudot consists of a start bit, five data bits and a stop bit. The five data bits are used to represent all 57 characters. Each code can represent either of two characters, a letter or a figure. The printer is told which of the two possible characters to print by a special shift code that is transmitted preceding

each string of characters of the same type. Carriage return, line feed and space, as well as the two shift codes, are common to both shift positions. If you are interested in a more detailed description of Baudot, as well as a listing of the codes, I refer you to the article by Haglund and Reed ("Baudot Interface Cookbook," *Kilobaud*, September 1978, p. 66).

How It Works

The program listing was written specifically for the SWTP 6800 computer but should run on any 6800 machine provided I/O and monitor addresses are compatible or changed as necessary. The technique used, however, should be applicable to any computer, and I have included a flowchart of the main part of the program, as well as a detailed description, to permit a similar program to be written for other computers (see Fig. 1).

I will describe the first part of the program, Initialize Pointers, only briefly since it is unique to the 6800. Basically, this portion reads the program start address from memory and uses this data to find the location in memory of the various tables and messages. This was done solely to make the program relocatable and can be dispensed with if you want to use a fixed address. The program, as written, can be loaded anywhere as long as the LSB of the address is 00. The next program section merely programs the output ACIA to operate the printer.

The third section, Set Operating Parameters, provides flexibility by permitting the user to choose between several options. As mentioned earlier, the decode portion of the program will operate with either wide or narrow shift. This is accomplished by loading MODSPC with the appropriate value in accordance with the user's input.

Most Baudot transmission is at 60 wpm, although 100 wpm is increasing. Seventy-five wpm is more rare. The program permits these three-speed options by adjusting DELAY1 and DELAY2, which provide the appropriate baud rate timing in the comput-

er. If your computer has baud rate signals of the proper values accessible in software, then you might want to make use of these.

The flowchart commences with the signal decode portion of the program. RTTY tones, in the form of square waves from the interface, are fed into a device on my computer called a control interface. This device is used to input serial data, although it is actually a parallel port—the serial-to-parallel conversion is in software. Input is fed to the high-order bit of the parallel port. By a shift-left instruction, the data is shifted into the carry register, which is queried to determine whether the input is high or low. Other machines can adopt their own methods of obtaining the same information.

With no signal input to the interface, the computer data bit will be high. The program remains in the top loop until an RTTY signal is detected by the input bit going low. Upon detection of the low, the program again loops in order to discard the first cycle of tone data which could be only a partial cycle.

Signal decoding actually starts at the label HRPT. A time counter, used to decode marks and spaces, is cleared, and an outer loop counter is set at six. The high- and low-signal loops operate as before, except now a counter is incremented on each cycle through the loop. Six complete cycles of the RTTY tone are counted to improve accuracy. I selected six cycles as a compromise between decode accuracy and the need to detect the beginning of a start bit for baud timing.

The two RTTY audio tones have different periods resulting in different time counts for a mark or space. Upon returning to the main program, the time count is compared with MODSPC. If the count is less than MODSPC, the signal is a space, or start bit. If not, the program loops back for another look. Transition between marking and a start bit can occur anytime, even during the middle of the six cycles counted. Therefore, DECODE is again entered for a confirming look.

With start bit received, the program clears a register to receive the incoming data and

sets a counter to keep track of the five data bits. At 60 wpm each bit is 22 milliseconds long, and sampling should be done near the center. Therefore, the program must mark time from near the beginning of the start bit to the center of the first data bit. DELAY1 provides this. At the label NEXT, DECODE is entered five times. After each return, MODSPC is checked for mark or space, or, as I have labeled them, a one or zero. The appropriate bit is then shifted into the data storage register. After each bit a delay of slightly less than 22 msec is introduced by DELAY2.

Subroutine OUTDAT translates from Baudot to ASCII, prints the data and stores the data in memory. OUTDAT checks the data for a carriage return, line feed or space and generates the appropriate ASCII form. If the code is none of these, the program will look for a figure or letters shift and store the appropriate shift data. Shift information is not stored in memory, only ASCII data. Any remaining characters are data.

The array TABLE contains the ASCII codes arranged in the

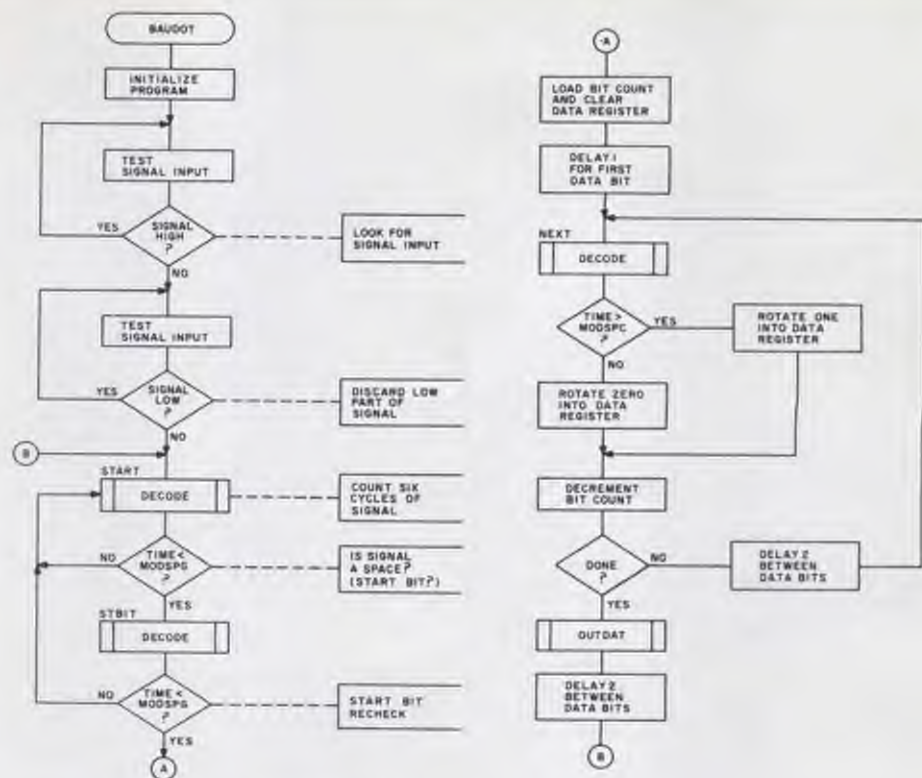


Fig. 1. Main program flowchart (continued on next page).

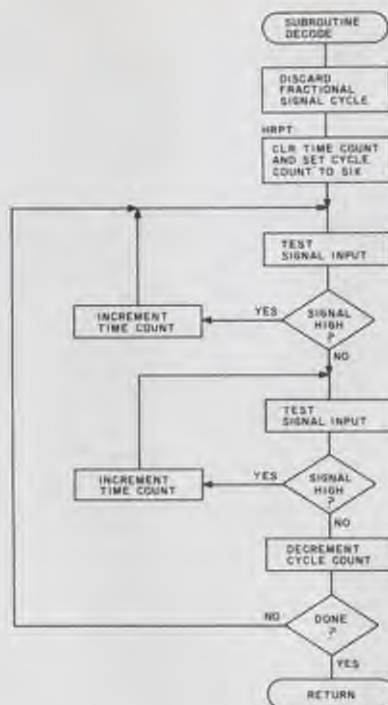
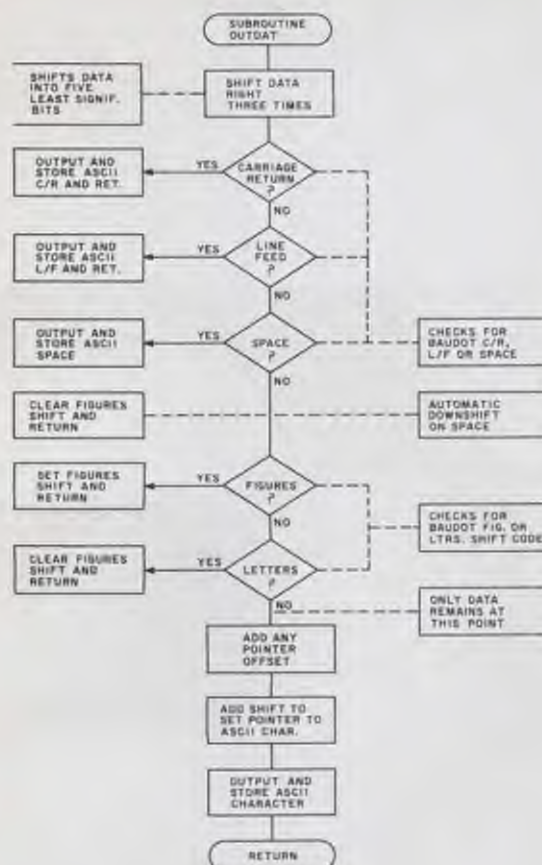


Fig. 1. (continued).

order of the corresponding Baudot code set. The input Baudot code itself then becomes the least significant half of the array pointer. The first 20 hex positions in TABLE contain ASCII letters, and the next 20 hex spaces contain the figures.

If the figures shift code has been received, a 20 hex will be stored in SHIFT and added to the pointer. If TABLE started at location XX00, then nothing more would be required. However, I loaded TABLE immediately following the program to save space. The actual location is found by adding an OFFSET to the Baudot code in addition to SHIFT.

The program uses the convention that reception of a space anywhere in the text will cause an automatic shift to Baudot letters mode, regardless of which shift was in use before (downshift on space). Upon receipt of a space, SHIFT is cleared to set letters mode.

Operation

In operation, the receiver is connected via its earphone or

external speaker jack to the input of the interface. If your receiver connection mutes the internal speaker, you may want to add some sort of monitor across the line so you can hear the input signal. It is helpful if you can observe the output of the interface on a scope while adjusting radio volume and input gain control of the interface. You want to get an output that looks as clean as possible with little jitter. Don't mistake mark-space shifts as jitter. I have found best results with my particular system with receiver audio set near maximum and interface gain reduced to about the center of the control.

Before entering the program, be sure to load A048-49 with program start address, even if your monitor does not require it. On going to the program, you will be asked to enter wide or narrow shift, speed and save data option.

One caution: If you elect to save the data in memory, don't forget to enter memory storage address range into A002-A005 before going to the program;

otherwise, you can wipe out your program. I know! Remember Glidewell's law: The more stupid the mistake, the longer it takes to find.

Once the specified field is filled, the program will halt, so give it enough room. The printer should now start printing.

I/O Interface

The interface circuit is shown in Fig. 2. The circuit is built around the same interface used for the tape recording system in my article, "6800 Tape System" (*Kilobaud Microcomputing*, December 1979, p. 78),

except the 7400 NAND gate has been replaced with a 74132 Schmitt trigger. The original circuit worked fine with narrow shift RTTY; however, when I went to wide shift, problems developed. These were caused by the limited audio bandwidth of the communications receiver that attenuated the high 2975 Hz tone. The 7900 op amp was added to provide some gain and limiting. Output of the 7900 is a chopped-off sine wave that is further squared in the 74132.

With no input signal, the output of the op amp is low. Since the RS-232 input on MP-C requires a low for no signal if the 20 mA loop section is being used, two sections of the 74132 are used to maintain the proper conditions.

If you are using only the 20 mA loop portion of the control interface, the circuit is connected directly to MP-C as shown in Fig. 2. Remove the ground strap from terminal RI and connect the interface directly in its place. Your system should work normally with no interaction between the two inputs on MP-C. If you are already using the RS-232 input (terminal RI) for another terminal, an SPDT switch, as indicated in Fig. 2 by the dashed lines, should be installed. After initializing the program, simply switch to the RTTY position.

The circuit is built on a two-IC board from Radio Shack (276-024). The cabinet is also from Radio Shack. Other parts came mostly from the junk box. I built a power supply in one of my duller moments. Current drain is so low, the 5 volts required could just as easily have

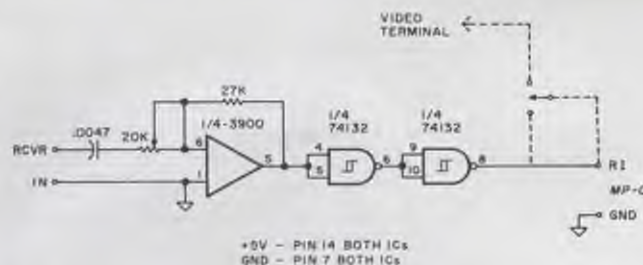


Fig. 2. The input interface circuit. The dashed lines are for an alternate connection if you already have another terminal connected to terminal RI on MP-C.

DISK DRIVES

TARBELL DISK CONTROLLER BOARD (Kit) Single Density \$179.00
PERTEC 5 1/4" disk drives for TRS-80 (Floppy Disk) \$359.00



This drive gives you 40 tracks of storage versus the 35 track Radio Shack drive. The Pertec drive also has the floppy disk feature. When you have filled one side of the diskette, flip it over and use the other side.
 Cable..... \$ 29.50

NEW DOS PLUS - DISK OPERATING SYSTEM FOR THE TRS-80

Some of the features include: Screen scrolling, print from screen, keyboard debounce, line renumbering, run DOS from Basic, auto program execution, level I in level II capability, "Superzap" that allows inspection and modification of disk or main memory, compatible with TRSDOS, will drive 40 track drives.

LIST \$110.00 OUR PRICE \$89.00
WITH DRIVE PURCHASE \$65.00

DISKETTES - VERBATIM 5 1/4" soft sector (TRS-80) Box of 10 \$ 28.50
 8" Soft sector FD 1000 Box of 10 \$ 38.50

COMPUTERS

TEXAS INSTRUMENTS 99/4 HOME COMPUTER \$1095.00



CPU - The powerful 9900 16 bit microprocessor with 256 byte scratch pad RAM. **MEMORY** - Total 72K bytes of ROM & RAM, external ROM memory - (Solid state software command modules) up to 30K bytes each, 16K user RAM. **KEYBOARD** - 40 key, full travel, overlay for second functions. **MUSIC & SOUND** - 5 octaves, 3 simultaneous tones plus noise generator. **DISPLAY** - 13" color monitor. **GRAPHICS** - 16 colors high resolution 192 x 256, you can define your own characters, create animated displays, charts, graphs and more. Built-in software - 14K byte BASIC interpreter 13 digit, floating point, internal graphics language interpreter, equation calculator & internal 4.4K byte monitor, recorder interface. **PERIPHERALS** - remote controls, solid state speech synthesizer, RS-232 interface.

CROMEMCO

Z-2 (Assm) \$ 845.00
 Z-2D (Assm) For rack mounting, 4Mz Z-80, Floppy Disk Controller, Mini-Floppy Disk Drive \$1779.00
 Z-3 (Assm) 4Mz Z-80, Dual 8" Drives, 32K RAM, Printer and RS-232 Interface \$4989.00
 Cobol, Fortran, Assmb., DBM, & other Cromemco software \$ 86.00
 TUART (Kit) \$176.00 TUART (Assm) \$255.00

CALL US FOR OTHER CROMEMCO DISCOUNTS

SUPERBRAIN

\$2845.00

Superbrain - The most cost effective machine on the market today. Intertec has combined their excellent video terminal with a sophisticated Z-80 computer and has come up with a totally integrated package. This beauty includes a 4Mz Z-80 computer system, 2 double density Mini-Floppies with 320K of disk storage, 64K of RAM memory, CP/M disk operating system with utilities, and a complete 80 character X24 line video smart terminal. This machine boasts two Z-80 processors to handle processing & I/O. A serial and parallel interface for the I/O is included. A S-100 edge connector is provided, so upgrading to 10-300 MB hard disks is available. If you need more info, call us.

EXIDY SORCERER W/16K \$1035.00
W/32K \$1135.00
GODBOUT UNKITS
 16K \$249.00 32K \$498.00 I/O Board \$184.00

TERMINALS

INTERTUBE II BY INTERTEC \$ 777.00



(Terminal) Z-80 controlled, 80 Char. by 24 lines, 128 upper and lower case, ASCII Char., graphic symbols, reversible video, half intensity video, special 25th display (status) line, 12" screen, operating mode: conversational, message, page, Char. insert/delete, line insert/delete, half or full duplex, keyboard with 18 key numeric pad, full cursor control, RS232 and 20/60 Ms loop auxiliary printer port, 75-9600 baud and a lot more special features all software controlled, no little mini-dip switches to bother with.

LEEDEX VIDEO 100 MONITOR \$ 138.00

CAT MODEM

Open up a whole new world of data and program exchange over the telephone. Allows one computer or terminal to talk to another. Can communicate with any Bell 103 compatible modem. RS232 interface and TRS-80 compatible.

NOVATION CAT ACOUSTICAL MODEL (300 baud) \$185.00



Tarbell Double Density Floppy Disk Interface FOR 8" DISK DRIVES

Under Tarbell Double-Density CP/M, single and double density disks may be intermixed. The system automatically determines whether single or double density is in place.

- Software select single or double density.
- Phase-locked-loop and write precompensation for reliable data recovery and storage.
- On-board phantom bootstrap PROM is disabled after bootstrap operation so all 64K memory address space is available to user.
- DMA in single or double density permits multi user operation.
- Extended addressing provides 8 extra address bits, permitting direct transfer anywhere in a 16 megabyte address range.
- Select up to 4 drives, single or double sided.
- New BIOS for CP/M included on single-density diskette.

Assembled and Tested..... \$398

Tarbell VDS-II Vertical Disk Subsystem SYSTEM INCLUDES:

- 2 Siemens 8" Disk Drives
- 1 Cabinet with Fan and Power Supply.
- 1 Tarbell Floppy Disk Interface, anid & tested
- 1 CP/M Disk Operating System.
- 1 Tarbell BASIC.
- All Cables and Connectors.
- Complete User Documentation.
- Fully Factory Assembled and Tested.

VDS-II Single Density..... \$1699
VDS-II Double Density..... \$1799



PRINTERS

TEXAS INSTRUMENTS PRINTER #810 (Up. & low. case) \$1689.00

The Paper Tiger is Here!



- Up to 198 characters per second
- 132 columns
- 6 or 8 lines per inch
- Eight software selectable character sizes
- 1.75" to 9.5" adjustable feed.
- Parallel (Centronics) and serial interface.

PAPER TIGER..... \$899
W/Graphics Option..... \$1078

Checks, money orders accepted

Add \$2.50 freight charges on orders under 10 lbs. Over 10 lbs. F.O.B. Cleveland

QUASAR DATA PRODUCTS

25151 Mitchell Dr., No. Olmsted, Ohio 44070 (216)779-9387

come from the computer I/O board. I use this same circuit for the tape system previously referenced; hence I incorporated a switch and extra jacks for this function. Also included on my board is an interface for transmission of RTTY using computer-generated tones.

Modifications

The program listing contains delay values to suit the original SWTP 6800. The 68/2 has a different clock circuit that runs around one MHz, so certain timing changes are required. These changes are listed in Table 1. The 68/2 does not use a crystal clock and may be subject to some drift. Since timing is fairly critical, particularly in DECODE, you should make sure you stay as close to one MHz as possible.

If you are writing a program for another computer, you will have to compute your own delays. The required values for MODSPC can either be computed or found by experimenting. In this latter case, it helps

to make a tape recording of each of the two (or three) audio tones. Play these tones into your version of DECODE and store the time count obtained after each sequence of six cycles. An examination of the results should provide a value for MODSPC. Select a point midway between the mark and space counts.

The program listing accepts input from a PIA on I/O board MP-C, but you can use a PIA in any I/O slot. To do this, one of the unused sections of the 74132 in Fig. 2 is added to the circuit in accordance with Fig. 3. You will have to change line 430 in the program listing to the address of the PIA. The extra program steps listed in Fig. 4 should be added to program the PIA as an input. Lines 1290 and 1300 of the original program can now be deleted as they are only used with the MP-C.

Output of the program is through a serial ACIA located in I/O slot three. Do not try to use the MP-C for output; it will not

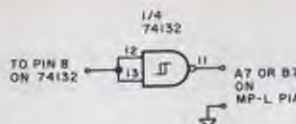


Fig. 3. Alternate connection for input to a PIA located in an I/O slot other than the control port.

work. Otherwise, either serial or parallel output can be used. For an ACIA, change line 470, PRT-DAT, to the appropriate address. If you plan to use a parallel port, the I/O routines in the program will have to be changed accordingly.

If your printer is connected to an ACIA in the control port, I/O slot one, you have two choices. You can use the I/O routine in the program by changing line 470 to \$8004 or you can use your monitor I/O routines with proper calls. One caution: using the monitor may cause trouble for a 110 baud printer when receiving at 100 wpm, particularly if your system has the 1.7971 MHz baud rate crystal.

Line No. Change

0910	LDA A #5AC
0980	LDA A #5C2
1000	LDX #50D4F
1020	LDX #5094E
1110	LDX #50715
1130	LDX #50527
1160	LDX #50A6B
1180	LDX #5075A

Table 1. Program changes necessary with a 1 MHz clock. These are computed values, but should work.

The baud rate generated is slightly low, and your printer may occasionally get behind when copying a slightly fast transmission. Programming the ACIA for one stop bit avoids this. For printers with faster baud rates there will be no problem.

Receivers

You will need a two-meter (144.5-148 MHz) FM receiver. The first choice is a regular amateur receiver. Kits for five-

Program listing.

```

00010  NAK      BAUDOT  VER 2.01 22 JAN 79
00020  * J. GLIDEWELL  WNKW
00030  * RECEIVES 5 LEVEL BAUDOT - OUTPUTS ASCII
00040  * DEMODULATES WIDE OR NARROW SPACE AFSK
00050  * OPERATES AT 60, 75 OR 100 WPM
00060  * PROGRAM WILL ASK FOR WIDE OR NARROW SHIFT
00070  * ENTER W OR N - NO CARRIAGE RETURN
00080  * ENTER SPEED AS REQUESTED
00090  * RECEIVED DATA (IN ASCII) CAN BE SAVED IN MEMORY
00100  * ENTER Y OR N TO SAVE/NOT SAVE DATA
00110  * IF DATA IS TO BE SAVED, ENTER ADDRESS: RANGE
00120  * IN A002-A005 BEFORE GOING TO PROGRAM
00130  * ALLOW SUFFICIENT MEMORY SPACE - PROGRAM WILL
00140  * RETURN TO CONTROL IF MEMORY SPACE FULL
00150  * ELEVEN MINUTES AT 60 WPM REQUIRES ABOUT 4K MEMORY
00160  * INITIALIZATION IS THROUGH CONTROL PORT - SLOT 1
00170  * INPUT IS THROUGH MP-C IN CONTROL PORT
00180  * WITH ACIA IN CONTROL PORT, CHANGE INPUT TO PIA
00190  * IN ANOTHER SLOT. CHANGE INPUT ADDRESS (LINE 430)
00200  * AS REQUIRED.
00210  * OUTPUT REQUIRES ACIA IN SLOT 3
00220  * PROGRAM START ADDRESS MUST BE ENTERED IN
00230  * A004-49 BEFORE PROGRAM IS RUN EVEN IF YOUR
00240  * MONITOR HAS A GO TO PROGRAM
00250  * PROGRAM CAN BE LOADED ANYWHERE IN MEMORY
00260  * PROVIDED LSB OF START ADDRESS IS 00.

00280  OPT      0.00G
00290  MSG11    EQU  $FC
00300  MSG22    EQU  $FE
00310  MSG33    EQU  $F0
00320  MSG44    EQU  $F2
00330  MSG44    EQU  $F4
00340  SAVE     EQU  $F4
00350  MODSPC   EQU  $F5
00360  DEL1     EQU  $F6
00370  DEL2     EQU  $F8
00380  ASCII    EQU  $FA
00390  OFFSET   EQU  $FC
00400  SHIFT    EQU  $FD
00410  TEMP3    EQU  $FE
00420  TEMP1    EQU  $A002
00430  TEMP2    EQU  $A004
00440  INPUT     EQU  $A004
00450  CTRL     EQU  $E0E3
00460  OUT      EQU  $E07E
00470  ETAC     EQU  $E1AC
00480  PRTDAT   EQU  $800C
00490  ORG      $8000

00500  * INITIALIZE POINTERS
00520  LDS      #A047
00530  LDA A    #A048
00540  INC A
00550  STA A    #A047
00560  STA A    #A048
00570  STA A    #A049
00580  STA A    #A04A
00590  STA A    #A04B
00600  STA A    #A04C
00610  STA A    #A04D
00620  STA A    #A04E
00630  STA A    #A04F
00640  STA A    #A050
00650  STA A    #A051
00660  STA A    #A052
00670  STA A    #A053
00680  STA A    #A054
00690  STA A    #A055
00700  STA A    #A056
00710  STA A    #A057
00720  STA A    #A058
00730  STA A    #A059
00740  STA A    #A05A
00750  STA A    #A05B
00760  STA A    #A05C
00770  STA A    #A05D
00780  STA A    #A05E
00790  STA A    #A05F
00800  STA A    #A060
00810  STA A    #A061
00820  STA A    #A062
00830  STA A    #A063
00840  STA A    #A064
00850  STA A    #A065
00860  STA A    #A066
00870  STA A    #A067
00880  STA A    #A068
00890  STA A    #A069
00900  STA A    #A06A
00910  STA A    #A06B
00920  STA A    #A06C
00930  STA A    #A06D
00940  STA A    #A06E
00950  STA A    #A06F
00960  STA A    #A070
00970  STA A    #A071
00980  STA A    #A072
00990  STA A    #A073
01000  STA A    #A074
01010  STA A    #A075
01020  STA A    #A076
01030  STA A    #A077
01040  STA A    #A078
01050  STA A    #A079
01060  STA A    #A07A
01070  STA A    #A07B
01080  STA A    #A07C
01090  STA A    #A07D
01100  STA A    #A07E
01110  STA A    #A07F
01120  STA A    #A080
01130  STA A    #A081
01140  STA A    #A082
01150  STA A    #A083
01160  STA A    #A084
01170  STA A    #A085
01180  STA A    #A086
01190  STA A    #A087
01200  STA A    #A088
01210  STA A    #A089
01220  STA A    #A08A
01230  STA A    #A08B
01240  STA A    #A08C
01250  STA A    #A08D
01260  STA A    #A08E
01270  STA A    #A08F
01280  STA A    #A090
01290  STA A    #A091
01300  STA A    #A092
01310  STA A    #A093
01320  STA A    #A094
01330  STA A    #A095
01340  STA A    #A096
01350  STA A    #A097
01360  STA A    #A098
01370  STA A    #A099
01380  STA A    #A09A
01390  STA A    #A09B
01400  STA A    #A09C
01410  STA A    #A09D
01420  STA A    #A09E
01430  STA A    #A09F
01440  STA A    #A0A0
01450  STA A    #A0A1
01460  STA A    #A0A2
01470  STA A    #A0A3
01480  STA A    #A0A4
01490  STA A    #A0A5
01500  STA A    #A0A6
01510  STA A    #A0A7
01520  STA A    #A0A8
01530  STA A    #A0A9
01540  STA A    #A0AA
01550  STA A    #A0AB
01560  STA A    #A0AC
01570  STA A    #A0AD
01580  STA A    #A0AE
01590  STA A    #A0AF
01600  STA A    #A0B0
01610  STA A    #A0B1
01620  STA A    #A0B2
01630  STA A    #A0B3
01640  STA A    #A0B4
01650  STA A    #A0B5
01660  STA A    #A0B6
01670  STA A    #A0B7
01680  STA A    #A0B8
01690  STA A    #A0B9
01700  STA A    #A0BA
01710  STA A    #A0BB
01720  STA A    #A0BC
01730  STA A    #A0BD
01740  STA A    #A0BE
01750  STA A    #A0BF
01760  STA A    #A0C0
01770  STA A    #A0C1
01780  STA A    #A0C2
01790  STA A    #A0C3
01800  STA A    #A0C4
01810  STA A    #A0C5
01820  STA A    #A0C6
01830  STA A    #A0C7
01840  STA A    #A0C8
01850  STA A    #A0C9
01860  STA A    #A0CA
01870  STA A    #A0CB
01880  STA A    #A0CC
01890  STA A    #A0CD
01900  STA A    #A0CE
01910  STA A    #A0CF
01920  STA A    #A0D0
01930  STA A    #A0D1
01940  STA A    #A0D2
01950  STA A    #A0D3
01960  STA A    #A0D4
01970  STA A    #A0D5
01980  STA A    #A0D6
01990  STA A    #A0D7
02000  STA A    #A0D8
02010  STA A    #A0D9
02020  STA A    #A0DA
02030  STA A    #A0DB
02040  STA A    #A0DC
02050  STA A    #A0DD
02060  STA A    #A0DE
02070  STA A    #A0DF
02080  STA A    #A0E0
02090  STA A    #A0E1
02100  STA A    #A0E2
02110  STA A    #A0E3
02120  STA A    #A0E4
02130  STA A    #A0E5
02140  STA A    #A0E6
02150  STA A    #A0E7
02160  STA A    #A0E8
02170  STA A    #A0E9
02180  STA A    #A0EA
02190  STA A    #A0EB
02200  STA A    #A0EC
02210  STA A    #A0ED
02220  STA A    #A0EE
02230  STA A    #A0EF
02240  STA A    #A0F0
02250  STA A    #A0F1
02260  STA A    #A0F2
02270  STA A    #A0F3
02280  STA A    #A0F4
02290  STA A    #A0F5
02300  STA A    #A0F6
02310  STA A    #A0F7
02320  STA A    #A0F8
02330  STA A    #A0F9
02340  STA A    #A0FA
02350  STA A    #A0FB
02360  STA A    #A0FC
02370  STA A    #A0FD
02380  STA A    #A0FE
02390  STA A    #A0FF
02400  STA A    #A100
02410  STA A    #A101
02420  STA A    #A102
02430  STA A    #A103
02440  STA A    #A104
02450  STA A    #A105
02460  STA A    #A106
02470  STA A    #A107
02480  STA A    #A108
02490  STA A    #A109
02500  STA A    #A10A
02510  STA A    #A10B
02520  STA A    #A10C
02530  STA A    #A10D
02540  STA A    #A10E
02550  STA A    #A10F
02560  STA A    #A110
02570  STA A    #A111
02580  STA A    #A112
02590  STA A    #A113
02600  STA A    #A114
02610  STA A    #A115
02620  STA A    #A116
02630  STA A    #A117
02640  STA A    #A118
02650  STA A    #A119
02660  STA A    #A11A
02670  STA A    #A11B
02680  STA A    #A11C
02690  STA A    #A11D
02700  STA A    #A11E
02710  STA A    #A11F
02720  STA A    #A120
02730  STA A    #A121
02740  STA A    #A122
02750  STA A    #A123
02760  STA A    #A124
02770  STA A    #A125
02780  STA A    #A126
02790  STA A    #A127
02800  STA A    #A128
02810  STA A    #A129
02820  STA A    #A12A
02830  STA A    #A12B
02840  STA A    #A12C
02850  STA A    #A12D
02860  STA A    #A12E
02870  STA A    #A12F
02880  STA A    #A130
02890  STA A    #A131
02900  STA A    #A132
02910  STA A    #A133
02920  STA A    #A134
02930  STA A    #A135
02940  STA A    #A136
02950  STA A    #A137
02960  STA A    #A138
02970  STA A    #A139
02980  STA A    #A13A
02990  STA A    #A13B
03000  STA A    #A13C
03010  STA A    #A13D
03020  STA A    #A13E
03030  STA A    #A13F
03040  STA A    #A140
03050  STA A    #A141
03060  STA A    #A142
03070  STA A    #A143
03080  STA A    #A144
03090  STA A    #A145
03100  STA A    #A146
03110  STA A    #A147
03120  STA A    #A148
03130  STA A    #A149
03140  STA A    #A14A
03150  STA A    #A14B
03160  STA A    #A14C
03170  STA A    #A14D
03180  STA A    #A14E
03190  STA A    #A14F
03200  STA A    #A150
03210  STA A    #A151
03220  STA A    #A152
03230  STA A    #A153
03240  STA A    #A154
03250  STA A    #A155
03260  STA A    #A156
03270  STA A    #A157
03280  STA A    #A158
03290  STA A    #A159
03300  STA A    #A15A
03310  STA A    #A15B
03320  STA A    #A15C
03330  STA A    #A15D
03340  STA A    #A15E
03350  STA A    #A15F
03360  STA A    #A160
03370  STA A    #A161
03380  STA A    #A162
03390  STA A    #A163
03400  STA A    #A164
03410  STA A    #A165
03420  STA A    #A166
03430  STA A    #A167
03440  STA A    #A168
03450  STA A    #A169
03460  STA A    #A16A
03470  STA A    #A16B
03480  STA A    #A16C
03490  STA A    #A16D
03500  STA A    #A16E
03510  STA A    #A16F
03520  STA A    #A170
03530  STA A    #A171
03540  STA A    #A172
03550  STA A    #A173
03560  STA A    #A174
03570  STA A    #A175
03580  STA A    #A176
03590  STA A    #A177
03600  STA A    #A178
03610  STA A    #A179
03620  STA A    #A17A
03630  STA A    #A17B
03640  STA A    #A17C
03650  STA A    #A17D
03660  STA A    #A17E
03670  STA A    #A17F
03680  STA A    #A180
03690  STA A    #A181
03700  STA A    #A182
03710  STA A    #A183
03720  STA A    #A184
03730  STA A    #A185
03740  STA A    #A186
03750  STA A    #A187
03760  STA A    #A188
03770  STA A    #A189
03780  STA A    #A18A
03790  STA A    #A18B
03800  STA A    #A18C
03810  STA A    #A18D
03820  STA A    #A18E
03830  STA A    #A18F
03840  STA A    #A190
03850  STA A    #A191
03860  STA A    #A192
03870  STA A    #A193
03880  STA A    #A194
03890  STA A    #A195
03900  STA A    #A196
03910  STA A    #A197
03920  STA A    #A198
03930  STA A    #A199
03940  STA A    #A19A
03950  STA A    #A19B
03960  STA A    #A19C
03970  STA A    #A19D
03980  STA A    #A19E
03990  STA A    #A19F
04000  STA A    #A1A0
04010  STA A    #A1A1
04020  STA A    #A1A2
04030  STA A    #A1A3
04040  STA A    #A1A4
04050  STA A    #A1A5
04060  STA A    #A1A6
04070  STA A    #A1A7
04080  STA A    #A1A8
04090  STA A    #A1A9
04100  STA A    #A1AA
04110  STA A    #A1AB
04120  STA A    #A1AC
04130  STA A    #A1AD
04140  STA A    #A1AE
04150  STA A    #A1AF
04160  STA A    #A1B0
04170  STA A    #A1B1
04180  STA A    #A1B2
04190  STA A    #A1B3
04200  STA A    #A1B4
04210  STA A    #A1B5
04220  STA A    #A1B6
04230  STA A    #A1B7
04240  STA A    #A1B8
04250  STA A    #A1B9
04260  STA A    #A1BA
04270  STA A    #A1BB
04280  STA A    #A1BC
04290  STA A    #A1BD
04300  STA A    #A1BE
04310  STA A    #A1BF
04320  STA A    #A1C0
04330  STA A    #A1C1
04340  STA A    #A1C2
04350  STA A    #A1C3
04360  STA A    #A1C4
04370  STA A    #A1C5
04380  STA A    #A1C6
04390  STA A    #A1C7
04400  STA A    #A1C8
04410  STA A    #A1C9
04420  STA A    #A1CA
04430  STA A    #A1CB
04440  STA A    #A1CC
04450  STA A    #A1CD
04460  STA A    #A1CE
04470  STA A    #A1CF
04480  STA A    #A1D0
04490  STA A    #A1D1
04500  STA A    #A1D2
04510  STA A    #A1D3
04520  STA A    #A1D4
04530  STA A    #A1D5
04540  STA A    #A1D6
04550  STA A    #A1D7
04560  STA A    #A1D8
04570  STA A    #A1D9
04580  STA A    #A1DA
04590  STA A    #A1DB
04600  STA A    #A1DC
04610  STA A    #A1DD
04620  STA A    #A1DE
04630  STA A    #A1DF
04640  STA A    #A1E0
04650  STA A    #A1E1
04660  STA A    #A1E2
04670  STA A    #A1E3
04680  STA A    #A1E4
04690  STA A    #A1E5
04700  STA A    #A1E6
04710  STA A    #A1E7
04720  STA A    #A1E8
04730  STA A    #A1E9
04740  STA A    #A1EA
04750  STA A    #A1EB
04760  STA A    #A1EC
04770  STA A    #A1ED
04780  STA A    #A1EE
04790  STA A    #A1EF
04800  STA A    #A1F0
04810  STA A    #A1F1
04820  STA A    #A1F2
04830  STA A    #A1F3
04840  STA A    #A1F4
04850  STA A    #A1F5
04860  STA A    #A1F6
04870  STA A    #A1F7
04880  STA A    #A1F8
04890  STA A    #A1F9
04900  STA A    #A1FA
04910  STA A    #A1FB
04920  STA A    #A1FC
04930  STA A    #A1FD
04940  STA A    #A1FE
04950  STA A    #A1FF
04960  STA A    #A200
04970  STA A    #A201
04980  STA A    #A202
04990  STA A    #A203
05000  STA A    #A204
05010  STA A    #A205
05020  STA A    #A206
05030  STA A    #A207
05040  STA A    #A208
05050  STA A    #A209
05060  STA A    #A20A
05070  STA A    #A20B
05080  STA A    #A20C
05090  STA A    #A20D
05100  STA A    #A20E
05110  STA A    #A20F
05120  STA A    #A210
05130  STA A    #A211
05140  STA A    #A212
05150  STA A    #A213
05160  STA A    #A214
05170  STA A    #A215
05180  STA A    #A216
05190  STA A    #A217
05200  STA A    #A218
05210  STA A    #A219
05220  STA A    #A21A
05230  STA A    #A21B
05240  STA A    #A21C
05250  STA A    #A21D
05260  STA A    #A21E
05270  STA A    #A21F
05280  STA A    #A220
05290  STA A    #A221
05300  STA A    #A222
05310  STA A    #A223
05320  STA A    #A224
05330  STA A    #A225
05340  STA A    #A226
05350  STA A    #A227
05360  STA A    #A228
05370  STA A    #A229
05380  STA A    #A22A
05390  STA A    #A22B
05400  STA A    #A22C
05410  STA A    #A22D
05420  STA A    #A22E
05430  STA A    #A22F
05440  STA A    #A230
05450  STA A    #A231
05460  STA A    #A232
05470  STA A    #A233
05480  STA A    #A234
05490  STA A    #A235
05500  STA A    #A236
05510  STA A    #A237
05520  STA A    #A238
05530  STA A    #A239
05540  STA A    #A23A
05550  STA A    #A23B
05560  STA A    #A23C
05570  STA A    #A23D
05580  STA A    #A23E
05590  STA A    #A23F
05600  STA A    #A240
05610  STA A    #A241
05620  STA A    #A242
05630  STA A    #A243
05640  STA A    #A244
05650  STA A    #A245
05660  STA A    #A246
05670  STA A    #A247
05680  STA A    #A248
05690  STA A    #A249
05700  STA A    #A24A
05710  STA A    #A24B
05720  STA A    #A24C
05730  STA A    #A24D
05740  STA A    #A24E
05750  STA A    #A24F
05760  STA A    #A250
05770  STA A    #A251
05780  STA A    #A252
05790  STA A    #A253
05800  STA A    #A254
05810  STA A    #A255
05820  STA A    #A256
05830  STA A    #A257
05840  STA A    #A258
05850  STA A    #A259
05860  STA A    #A25A
05870  STA A    #A25B
05880  STA A    #A25C
05890  STA A    #A25D
05900  STA A    #A25E
05910  STA A    #A25F
05920  STA A    #A260
05930  STA A    #A261
05940  STA A    #A262
05950  STA A    #A263
05960  STA A    #A264
05970  STA A    #A265
05980  STA A    #A266
05990  STA A    #A267
06000  STA A    #A268
06010  STA A    #A269
06020  STA A    #A26A
06030  STA A    #A26B
06040  STA A    #A26C
06050  STA A    #A26D
06060  STA A    #A26E
06070  STA A    #A26F
06080  STA A    #A270
06090  STA A    #A271
06100  STA A    #A272
06110  STA A    #A273
06120  STA A    #A274
06130  STA A    #A275
06140  STA A    #A276
06150  STA A    #A277
06160  STA A    #A278
06170  STA A    #A279
06180  STA A    #A27A
06190  STA A    #A27B
06200  STA A    #A27C
06210  STA A    #A27D
06220  STA A    #A27E
06230  STA A    #A27F
06240  STA A    #A280
06250  STA A    #A281
06260  STA A    #A282
06270  STA A    #A283
06280  STA A    #A284
06290  STA A    #A285
06300  STA A    #A286
06310  STA A    #A287
06320  STA A    #A288
06330  STA A    #A289
06340  STA A    #A28A
06350  STA A    #A28B
06360  STA A    #A28C
06370  STA A    #A28D
06380  STA A    #A28E
06390  STA A    #A28F
06400  STA A    #A290
06410  STA A    #A291
06420  STA A    #A292
06430  STA A    #A293
06440  STA A    #A294
06450  STA A    #A295
06460  STA A    #A296
06470  STA A    #A297
06480  STA A    #A298
06490  STA A    #A299
06500  STA A    #A29A
06510  STA A    #A29B
06520  STA A    #A29C
06530  STA A    #A29D
06540  STA A    #A29E
06550  STA A    #A29F
06560  STA A    #A2A0
06570  STA A    #A2A1
06580  STA A    #A2A2
06590  STA A    #A2A3
06600  STA A    #A2A4
06610  STA A    #A2A5
06620  STA A    #A2A6
06630  STA A    #A2A7
06640  STA A    #A2A8
06650  STA A    #A2A9
06660  STA A    #A2AA
06670  STA A    #A2AB
06680  STA A    #A2AC
06690  STA A    #A2AD
06700  STA A    #A2AE
06710  STA A    #A2AF
06720  STA A    #A2B0
06730  STA A    #A2B1
06740  STA A    #A2B2
06750  STA A    #A2B3
06760  STA A    #A2B4
06770  STA A    #A2B5
06780  STA A    #A2B6
06790  STA A    #A2B7
06800  STA A    #A2B8
06810  STA A    #A2B9
06820  STA A    #A2BA
06830  STA A    #A2BB
06840  STA A    #A2BC
06850  STA A    #A2BD
06860  STA A    #A2BE
06870  STA A    #A2BF
06880  STA A    #A2C0
06890  STA A    #A2C1
06900  STA A    #A2C2
06910  STA A    #A2C3
06920  STA A    #A2C4
06930  STA A    #A2C5
06940  STA A    #A2C6
06950  STA A    #A2C7
06960  STA A    #A2C8
06970  STA A    #A2C9
06980  STA A    #A2CA
06990  STA A    #A2CB
07000  STA A    #A2CC
07010  STA A    #A2CD
07020  STA A    #A2CE
07030  STA A    #A2CF
07040  STA A    #A2D0
07050  STA A    #A2D1
07060  STA A    #A2D2
07070  STA A    #A2D3
07080  STA A    #A2D4
07090  STA A    #A2D5
07100  STA A    #A2D6
07110  STA A    #A2D7
07120  STA A    #A2D8
07130  STA A    #A2D9
07140  STA A    #A2DA
0715
```


00610 6920 96 FF	LDA A	TEMP3+1	01390 69B3 24 FA	BSR	CL	OF FIRST CYCLE
00620 6922 97 EF	STA A	MS022+1	01400 69B5 8D 3B	RSR	DECODE	FETCH CYCLE TIME COUNT
00630 6924 CE 4B14	LDA A	MS03	01410 69B7 D1 F5	CMP B	MODSPC	IS IT A SPACE?
00640 6927 DF FE	STX	TEMP3	01420 69B9 23 04	BSR	STBIT	YES - GO MAKE SECOND COUNT
00650 6929 96 FF	LDA A	TEMP3+1	01430 69BB RD 41	BSR	HRPT	NO - CHECK AGAIN
00660 692B 97 F1	STA A	MS033+1	01440 69BD 28 F9	BSR	TEST	
00670 692D CE 6B28	LDA A	MS04	01450 69BF 8D 3D	RSR	HRPT	MAKE SECOND TIME COUNT
00680 6930 DF FE	STX	TEMP3	01460 69C1 D1 F5	CMP B	MODSPC	SPACE?
00690 6932 96 FF	LDA A	TEMP3+1	01470 69C3 22 F6	BHI	RP1	NO - GO BACK AGAIN
00700 6934 97 F3	STA A	MS044+1	01480 69C5 C6 05	LDA A	#5	YES - LOAD BIT COUNT
00710 6936 CE 6A8A	LDA A	MS05	01490 69C7 37	PSM B		SAVE BIT COUNT
00720 6939 DF FB	STX	ASC11+1	01500 69C9 4F	CLR A		CLEAR DATA SPACE
00730 693B 7F 0BFD	CLR	SHIFT	01510 69CB 36	PSM A		SAVE DATA SPACE
00740 693D 96 FF	LDA A	TEMP3+1	01520 69CD 8D 47	RSR	DELAY1	DELAY FOR FIRST DATA BIT
00750 693F 97 F3	STA A	MS06	01530 69CE D1 F5	CMP B	MODSPC	SPACE?
00760 6941 86 03	LDA A	#03	01540 69D0 22 0D	BHI	ONE	NO - THEN IS A ZERO
00770 6943 A7 00	STA A	#X	01550 69D2 32	PUL A		RECOVER DATA
00780 6945 86 4D	LDA A	#54D	01560 69D4 46	CLC		CLEAR CARRY BIT
00790 6947 A7 00	STA A	#X	01570 69D6 5A	ROR A		ROTATE ZERO INTO DATA
00800 6949 86 AC	LDA A	#57	01580 69D8 3C	PUL B		RECOVER BIT COUNT
00810 694B 86 AC	LDA A	#57	01590 69DA 27 13	DEC B	ASC	FIVE DATA BITS IN?
00820 694D 86 AC	LDA A	#57	01600 69DC 37	BEQ		YES - GO TRANSLATE DATA
00830 694F 86 AC	LDA A	#57	01610 69DE 37	PSM B		NO - SAVE BIT COUNT
00840 6951 86 AC	LDA A	#57	01620 69E0 0D	BSR	DELAY2	SAVE DATA
00850 6953 86 AC	LDA A	#57	01630 69E2 33	BSR	NEXT	DELAY TO NEXT BIT
00860 6955 86 AC	LDA A	#57	01640 69E4 27 06	BSR	ONE	GET NEXT BIT
00870 6957 86 AC	LDA A	#57	01650 69E6 37	PUL A		RECOVER DATA
00880 6959 86 AC	LDA A	#57	01660 69E8 2F	SEC		SET CARRY BIT TO ONE
00890 695B 86 AC	LDA A	#57	01670 69EA 28 E8	ROR A		ROTATE ONE INTO DATA
00900 695D 86 AC	LDA A	#57	01680 69EC 8D 31	PUL B		RECOVER BIT COUNT
00910 695F 86 AC	LDA A	#57	01690 69EE RD 29	DEC B	ASC	FIVE DATA BITS IN?
00920 6961 86 AC	LDA A	#57	01700 69F0 28 C3	BEQ		YES - GO TRANSLATE DATA
00930 6963 86 AC	LDA A	#57	01710 69F2 0D	PSM B		SAVE BIT COUNT
00940 6965 86 AC	LDA A	#57	01720 69F4 36	BSR	DELAY2	SAVE DATA
00950 6967 86 AC	LDA A	#57	01730 69F6 25 FA	BSR	NEXT	DELAY TO NEXT BIT
00960 6969 86 AC	LDA A	#57	01740 69F8 28 C3	BSR	OUTDAT	GET NEXT BIT
00970 696B 86 AC	LDA A	#57	01750 69FA 25 FA	BSR	ASC	GO OUTPUT DATA
00980 696D 86 AC	LDA A	#57	01760 69FC 24 FA	BSR	DELAY2	DELAY FOR STOP BIT
00990 696F 86 AC	LDA A	#57	01770 69FE 3F	BSR	START	RETURN FOR NEXT CHR
01000 6971 27 10	CMP A	#537	01780 69F0 28 C3	SEC	INPUT	CLEAR ANY FRACTIONAL CYCLES
01010 6973 81 31	BEQ	S75	01790 69F2 0D	RCL	DECODE	
01020 6975 26 16	CMP A	#531	01800 69F4 36	RCS	HL	CLEAR LOWS
01030 6977 CE 065D	LDA A	#065D	01810 69F6 25 FA	SEC		CLEAR TIME COUNT
01040 6979 DF F8	STX	DEL1	01820 69F8 RD	RCC	CLR B	SET CYCLE COUNT
01050 697B DF F8	STX	DEL2	01830 69FA 28 C3	HRPT	LDA A	#006
01060 697D DF F8	STX	DEL2	01840 69FC 24 FA	HRPT	LDA A	#006
01070 697F DF F8	STX	DEL2	01850 69FE 3F	HRPT	LDA A	#006
01080 6981 20 0A	BSR	SAV	01860 69FF 36 06	HRPT	LDA A	#006
01090 6983 CE 065D	LDA A	#065D	01870 6A01 0D	HRPT	LDA A	#006
01100 6985 DF F8	STX	DEL1	01880 6A02 79 8004	HRPT	LDA A	#006
01110 6987 DF F8	STX	DEL1	01890 6A05 5C	HRPT	LDA A	#006
01120 6989 DF F8	STX	DEL1	01900 6A08 25 F9	HRPT	LDA A	#006
01130 698B DF F8	STX	DEL1	01910 6A0A 0D	HRPT	LDA A	#006
01140 698D DF F8	STX	DEL1	01920 6A0C 0D	HRPT	LDA A	#006
01150 698F DF F8	STX	DEL1	01930 6A0E 5C	HRPT	LDA A	#006
01160 6991 20 0A	BSR	SAV	01940 6A10 24 F9	HRPT	LDA A	#006
01170 6993 CE 065D	LDA A	#065D	01950 6A12 39	HRPT	LDA A	#006
01180 6995 DF F8	STX	DEL1	01960 6A14 24 EF	HRPT	LDA A	#006
01190 6997 DF F8	STX	DEL1	01970 6A16 26 FD	HRPT	LDA A	#006
01200 6999 DF F8	STX	DEL1	01980 6A18 39	HRPT	LDA A	#006
01210 699B DF F8	STX	DEL1	01990 6A1A 39	HRPT	LDA A	#006
01220 699D DF F8	STX	DEL1	02000 6A1C 26 FD	HRPT	LDA A	#006
01230 699F DF F8	STX	DEL1	02010 6A1E 39	HRPT	LDA A	#006
01240 69A1 20 0A	BSR	SAV	02020 6A1F 44	HRPT	LDA A	#006
01250 69A3 CE 065D	LDA A	#065D	02030 6A20 44	HRPT	LDA A	#006
01260 69A5 DF F8	STX	DEL1	02040 6A22 44	HRPT	LDA A	#006
01270 69A7 DF F8	STX	DEL1	02050 6A24 44	HRPT	LDA A	#006
01280 69A9 DF F8	STX	DEL1	02060 6A26 44	HRPT	LDA A	#006
01290 69AB DF F8	STX	DEL1	02070 6A28 44	HRPT	LDA A	#006
01300 69AD DF F8	STX	DEL1	02080 6A2A 44	HRPT	LDA A	#006
01310 69AF DF F8	STX	DEL1	02090 6A2C 44	HRPT	LDA A	#006
01320 69B1 20 0A	BSR	SAV	02100 6A2E 44	HRPT	LDA A	#006
01330 69B3 CE 065D	LDA A	#065D	02110 6A30 44	HRPT	LDA A	#006
01340 69B5 DF F8	STX	DEL1	02120 6A32 44	HRPT	LDA A	#006
01350 69B7 DF F8	STX	DEL1	02130 6A34 44	HRPT	LDA A	#006
01360 69B9 DF F8	STX	DEL1	02140 6A36 44	HRPT	LDA A	#006
01370 69BB DF F8	STX	DEL1	02150 6A38 44	HRPT	LDA A	#006
01380 69BD DF F8	STX	DEL1	02160 6A3A 44	HRPT	LDA A	#006
01390 69BF DF F8	STX	DEL1	02170 6A3C 44	HRPT	LDA A	#006
01400 69C1 DF F8	STX	DEL1	02180 6A3E 44	HRPT	LDA A	#006
01410 69C3 DF F8	STX	DEL1	02190 6A40 44	HRPT	LDA A	#006
01420 69C5 DF F8	STX	DEL1	02200 6A42 44	HRPT	LDA A	#006
01430 69C7 DF F8	STX	DEL1	02210 6A44 44	HRPT	LDA A	#006
01440 69C9 DF F8	STX	DEL1	02220 6A46 44	HRPT	LDA A	#006
01450 69CB DF F8	STX	DEL1	02230 6A48 44	HRPT	LDA A	#006
01460 69CD DF F8	STX	DEL1	02240 6A4A 44	HRPT	LDA A	#006
01470 69CE DF F8	STX	DEL1	02250 6A4C 44	HRPT	LDA A	#006
01480 69CF DF F8	STX	DEL1	02260 6A4E 44	HRPT	LDA A	#006
01490 69D1 DF F8	STX	DEL1	02270 6A50 44	HRPT	LDA A	#006
01500 69D3 DF F8	STX	DEL1	02280 6A52 44	HRPT	LDA A	#006
01510 69D5 DF F8	STX	DEL1	02290 6A54 44	HRPT	LDA A	#006
01520 69D7 DF F8	STX	DEL1	02300 6A56 44	HRPT	LDA A	#006
01530 69D9 DF F8	STX	DEL1	02310 6A58 44	HRPT	LDA A	#006
01540 69DB DF F8	STX	DEL1	02320 6A5A 44	HRPT	LDA A	#006
01550 69DD DF F8	STX	DEL1	02330 6A5C 44	HRPT	LDA A	#006
01560 69DF DF F8	STX	DEL1	02340 6A5E 44	HRPT	LDA A	#006
01570 69E1 DF F8	STX	DEL1	02350 6A60 44	HRPT	LDA A	#006
01580 69E3 DF F8	STX	DEL1	02360 6A62 44	HRPT	LDA A	#006
01590 69E5 DF F8	STX	DEL1	02370 6A64 44	HRPT	LDA A	#006
01600 69E7 DF F8	STX	DEL1	02380 6A66 44	HRPT	LDA A	#006
01610 69E9 DF F8	STX	DEL1	02390 6A68 44	HRPT	LDA A	#006
01620 69EB DF F8	STX	DEL1	02400 6A6A 44	HRPT	LDA A	#006
01630 69ED DF F8	STX	DEL1	02410 6A6C 44	HRPT	LDA A	#006
01640 69EF DF F8	STX	DEL1	02420 6A6E 44	HRPT	LDA A	#006
01650 69F1 DF F8	STX	DEL1	02430 6A70 44	HRPT	LDA A	#006
01660 69F3 DF F8	STX	DEL1	02440 6A72 44	HRPT	LDA A	#006
01670 69F5 DF F8	STX	DEL1	02450 6A74 44	HRPT	LDA A	#006
01680 69F7 DF F8	STX	DEL1	02460 6A76 44	HRPT	LDA A	#006
01690 69F9 DF F8	STX	DEL1	02470 6A78 44	HRPT	LDA A	#006
01700 69FB DF F8	STX	DEL1	02480 6A7A 44	HRPT	LDA A	#006
01710 69FD DF F8	STX	DEL1	02490 6A7C 44	HRPT	LDA A	#006
01720 69FF DF F8	STX	DEL1	02500 6A7E 44	HRPT	LDA A	#006
01730 6A01 DF F8	STX	DEL1	02510 6A80 44	HRPT	LDA A	#006
01740 6A03 DF F8	STX	DEL1	02520 6A82 44	HRPT	LDA A	#006
01750 6A05 DF F8	STX	DEL1	02530 6A84 44	HRPT	LDA A	#006
01760 6A07 DF F8	STX	DEL1	02540 6A86 44	HRPT	LDA A	#006
01770 6A09 DF F8	STX	DEL1	02550 6A88 44	HRPT	LDA A	#006
01780 6A0B DF F8	STX	DEL1	02560 6A8A 44	HRPT	LDA A	#006
01790 6A0D DF F8	STX	DEL1	02570 6A8C 44	HRPT	LDA A	#006
01800 6A0F DF F8	STX	DEL1	02580 6A8E 44	HRPT	LDA A	#006
01810 6A11 DF F8	STX	DEL1	02590 6A90 44	HRPT	LDA A	#006
01820 6A13 DF F8	STX	DEL1	02600 6A92 44	HRPT	LDA A	#006
01830 6A15 DF F8	STX	DEL1	02610 6A94 44	HRPT	LDA A	#006
01840 6A17 DF F8	STX	DEL1	02620 6A96 44	HRPT	LDA A	#006
01850 6A19 DF F8	STX	DEL1	02630 6A98 44	HRPT	LDA A	#006
01860 6A1B DF F8	STX	DEL1	02640 6A9A 44	HRPT	LDA A	#006
01870 6A1D DF F8	STX	DEL1	02650 6A9C 44	HRPT	LDA A	#006
01880 6A1F DF F8	STX	DEL1	02660 6A9E 44	HRPT	LDA A	#006
01890 6A21 DF F8	STX	DEL1	02670 6A9F 44	HRPT	LDA A	#006
01900 6A23 DF F8	STX	DEL1	02680 6AA1 44	HRPT	LDA A	#006
01910 6A25 DF F8	STX	DEL1	02690 6AA3 44	HRPT	LDA A	#006
01920 6A27 DF F8	STX	DEL1	02700 6AA5 44	HRPT	LDA A	#006
01930 6A29 DF F8	STX	DEL1	02710 6AA7 44	HRPT	LDA A	#006
01940 6A2B DF F8	STX	DEL1	02720 6AA9 44	HRPT	LDA A	#006
01950 6A2D DF F8	STX	DEL1	02730 6AAB 44	HRPT	LDA A	#006
01960 6A2F DF F8	STX	DEL1	02740 6AAC 44	HRPT	LDA A	#006
01970 6A31 DF F8	STX	DEL1	02750 6AAE 44	HRPT	LDA A	#006
01980 6A33 DF F8	STX	DEL1	02760 6AB0 44	HRPT	LDA A	#006
01990 6A35 DF F8	STX	DEL1	02770 6AB2 44	HRPT	LDA A	#006
02000 6A37 DF F8	STX	DEL1	02780 6AB4 44	HRPT	LDA A	#006
02010 6A39 DF F8	STX	DEL1	02790 6AB6 44	HRPT	LDA A	#006
02020 6A3B DF F8	STX	DEL1	02800 6AB8 44	HRPT	LDA A	#006
02030 6A3D DF F8	STX	DEL1	02810 6ABA 44	HRPT	LDA A	#006
02040 6A3F DF F8	STX	DEL1	02820 6ABC 44	HRPT	LDA A	#006
02050 6A41 DF F8	STX	DEL1	02830 6ABE 44	HRPT	LDA A	#006
02060 6A43 DF F8	STX	DEL1	02840 6ABF 44	HRPT	LDA A	#006
02070 6A45 DF F8	STX	DEL1	02850 6AC1 44	HRPT	LDA A	#006
02080 6A47 DF F8	STX	DEL1	02860 6AC3 44	HRPT	LDA A	#006
02090 6A49 DF F8	STX	DEL1	02870 6AC5 44	HRPT	LDA A	#006
02100 6A4B DF F8	STX	DEL1	02880 6AC7 44	HRPT	LDA A	#006
02110 6A4D DF F8	STX	DEL1	02890 6AC9 44	HRPT	LDA A	#006
02120 6A4F DF F8	STX	DEL1	02900 6ACA 44	HRPT	LDA A	#006
02130 6A51 DF F8	STX	DEL1	02910 6ACE 44	HRPT	LDA A	#006
02140 6A53 DF F8	STX	DEL1	02920 6ACF 44	HRPT	LDA A	#006
02150 6A55 DF F8	STX	DEL1	02930 6AD1 44	HRPT	LDA A	#006
02160 6A57 DF F8	STX	DEL1	02940 6AD3 44	HRPT	LDA A	#006
02170 6A59 DF F8	STX	DEL1	02950 6AD5 44	HRPT	LDA A	#006
02180 6						

or six-channel receivers are available for about \$60 to \$70. These are crystal controlled so a crystal for each frequency used will also be required. Consult the various ham magazines such as *73 Magazine*.

Another choice is one of the many PSB Hi band VHF scanners around. These are often excellent receivers, and many cover at least the important portion of the two-meter band, 146-148 MHz. Even if their coverage is listed only down to 148 MHz, most will operate at the lower frequencies. Many hams use these for monitors.

The last choice is one of the tunable PSB receivers. Their

main advantage is you can tune to find RTTY signals, recognizable by their chirping sound. Their main disadvantage is lack of sensitivity and poor selectivity. This means that in the populated areas where there are many stations, interference is likely. Also their poor sensitivity, particularly in the lower-priced receivers, requires a stronger signal.

If you already have a good communications-type short-wave receiver with an FM detector, another possibility is to add a converter. Converter kits are available for under \$40. This method has the advantage of requiring no crystals, and you can tune the entire two-meter band.

Reliable range of two meters depends largely on the antenna height of both transmitter and receiver. When two stations are communicating directly to each other, alternately using the same frequency (Simplex), range may vary from a few miles to 10 or 20 miles, al-

though much longer ranges are obtained. A repeater is a device that receives a signal and retransmits it on a different frequency, usually with higher power and from a better antenna location. Through repeaters, ranges of maybe 30 to over 100 miles are usual. Many localities now have RTTY repeaters operating.

How do you find the frequency(s) used for RTTY? The best way is to ask a ham. Our local computer club has a dozen or more ham members, so try your club. If you don't know any hams, maybe a friend does. With a tunable receiver, you can listen. If all you hear is voice, keep listening, particularly in the early evening. Even RTTY repeaters are used more for voice than RTTY. If yours is a crystal-controlled set, then you must find the frequency in order to obtain the proper crystals.

Some Possibilities

Amateurs are not permitted

to broadcast one-way signals, so a ham buddy cannot legally send to you, a non-ham. But suppose a couple or more hams in the computer club arrange a schedule to transmit programs back and forth to each other at 8 PM Tuesday. There is no reason you shouldn't eavesdrop, and if you cannot hear one of them, possibly the other is on your side of town.

Programs can be stored on tape instead of being printed. They can then be loaded into the computer or printed from the tapes. It makes no difference what your tape baud rate is; it will simply take much more tape than usual because of the low speed of incoming data.

If anyone would like to try this program but doesn't want to key it in by hand, I can furnish an object tape for \$4. Please specify starting address of 0100, 2000 or 6900. Alternately, I could provide a tape copy of the assembler program for the SWTP Co-Res Assembler. All tapes are 300 baud KC. ■

```
0430 INPUT EQU $(NEW ADDRESS)
0811 LDX #INPUT
0812 CLR O,X
0813 LDA A #4
0814 STA A 1,X
```

Fig. 4. Program additions for use with a PIA, other than the MP-C, for input.

02110	6A21 44	LSR A	#50A	CARRIAGE RETURN?
02120	6A22 81 08	CMP A	CR	YES
02130	6A24 27 1F	BEQ		LINE FEED?
02140	6A26 81 02	CMP A	#502	YES
02150	6A28 27 22	BEQ	LF	SPACE?
02160	6A2A 81 04	CMP A	#504	YES
02170	6A2C 27 25	BEQ	SP	FIGURES?
02180	6A2E 81 1B	CMP A	#518	YES
02190	6A30 27 28	BEQ	FIG	LETTERS?
02200	6A32 81 1F	CMP A	#51F	YES
02210	6A34 27 2C	BEQ	LTRS	ADD OFFSET TO POINTER
02220	6A36 9B FC	ADD A	OFFSET	ADD FIG SHIFT TO POINTER
02230	6A38 9B FD	ADD A	SHIFT	STORE IN LSR OF POINTER
02240	6A3A 97 FB	STA	ASCII+1	LOAD POINTER TO ASCII
02250	6A3C DE FA	LDA	ASCII	FETCH ASCII DATA
02260	6A3E A6 0A	LDA	A,X	
02270	6A40 8D 2F	BSR	STORE	
02280	6A42 8D 22	BSR	PRINT	
02290	6A44 39	RTS		
02300	6A45 86 0D	LDA	#50D	LOAD A WITH CARRIAGE RET
02310	6A47 8D 28	BSR	STORE	STORE DATA
02320	6A49 8D 1B	BSR	PRINT	OUTPUT DATA
02330	6A4B 39	RTS		
02340	6A4C 86 0A	LDA	#50A	LOAD LINE FEED
02350	6A4E 8D 21	BSR	STORE	
02360	6A50 8D 14	BSR	PRINT	
02370	6A52 39	RTS		
02380	6A53 86 20	LDA	#520	LOAD SPACE
02390	6A55 7F 09FD	CLR	SHIFT	CLEAR FIGURE SHIFT
02400	6A58 8D 17	BSR	STORE	
02410	6A5A 8D 0A	BSR	PRINT	
02420	6A5C 39	RTS		
02430	6A5D 86 20	LDA	#520	LOAD FIGURE OFFSET TO
02440	6A5F 97 FD	STA	SHIFT	POINTER SHIFT
02450	6A61 39	RTS		
02460	6A62 7F 09FD	CLR	SHIFT	CLEAR FIGURE SHIFT
02470	6A65 39	RTS		
02480	6A66 C6 02	PRINT		
02490	6A68 F4 800C	AND B		ACIA DATA REG EMPTY?
02500	6A6B 27 F9	BEQ	PRIDAT	NO - LOOK AGAIN
02510	6A6D 87 800D	STA	PRIDAT+1	PRINT DATA
02520	6A70 39	RTS		
02530	6A71 7D 08F4	STORE	TST	DATA TO BE SAVED?
02540	6A74 26 13	BNE	SKIP	NO - THEN SKIP
02550	6A76 FE A002	LDA	TEMP1	FETCH STORAGE POINTER
02560	6A79 A7 00	STA	A,X	SAVE DATA
02570	6A7B BC A004	CPX	TEMP2	MEMORY FULL?
02580	6A7E 26 05	BNE	CONT	NO - CONTINUE
02590	6A80 8D E4	BSR	PRINT	YES - PRINT LAST CHAR.
02600	6A82 7E E9E3	JMP	CONTR	EXIT
02610	6A85 00	INX		INC POINTER
02620	6A86 FF A002	CONT	TEMP1	SAVE POINTER
02630	6A89 39	SKIP		
02640	6A8A 00	TABLE		
02650	6A93 44	FCC		0, \$45, \$0A, \$41, \$20, \$53, \$49, \$55, \$5D
02660	6A95 00	FCC		*DRJNFKXTLZLWHP00RG*
02670	6A9F 07	FCC		0, \$4D, \$58, \$56, \$8, \$33, \$0A, \$2D, \$20
02680	6AA6 2C	FCC		7, \$38, \$37, \$0D, \$24, \$54, \$27
02690	6AA8 2A	FCC		1, \$C5, \$26, \$197A, +1,
02700	6A9D 0D	FCC		17, W OR N SHIFT -
02710	6ADC 0D	FCC		\$0A
02720	6AE2 57	FCC		\$0D, \$0A, \$FF, \$FF, \$FF
02730	6B02 36	FCC		WHAT SPEED? ENTER A: 7 OR 1 FOR /
02740	6B13 04	FCC		160, 75 100 WPM - /
02750	6B14 0D	FCC		\$0A
02760	6B1A 53	FCC		\$0D, \$0A, \$FF, \$FF, \$FF
02770	6B27 04	FCC		13, SAVE DATA? -
02780	6B2B 0D	FCC		\$0A
02790	6B2B 0D	FCC		\$0D, \$0A, \$0A
02790		END		



For Apple II



The Game That Drove Japan CRAZY!

SUPER INVADER



• Features superb high resolution graphics, nail-biting tension and hilarious antics by the moon creatures!

• Self-running "attract mode" of operation for easy learning and demonstrating of the game.

• As good in every way as the famous Invaders arcade game.

• High speed action !

• Sound effects!

• On cassette or 5" floppy disc.
CS-4005 CS-4503A

Only \$19.95

Requires 24K Apple II with Integer Basic
(main program is in machine code).



Order Today

Send payment plus \$1.00 shipping and handling in the U.S. (\$2.00 foreign) to Creative Computing Software, P.O. Box 789-M, Morristown, N.J. 07960. N.J. residents add \$1.00 sales tax. Visa, Master Charge and American Express orders may be called in toll free to 800-831-8112 (in N.J. 201-540-0445).

✓ C169

Produced under exclusive
license from Cosmos Software,
Astar International Co., Ltd.

**sensational
software**

**creative
computing
software**

**Creative Computing
Software**
P.O. Box 789-M
Morristown, NJ 07960

Dealer inquiries invited.

"Core" and More for Your Apple

You've yawned through the games. For serious computing, you'll need accessories.

A personal computer is much like a Barbie doll—once you have purchased the bare unit, the price of wardrobe and accessories can easily equal or surpass the original price tag! Small wonder the new micro-computer owner feels intimidated by the vast array of hardware and accessories available for his system.

Like you, I studied specification sheets for quite a while before purchasing my Apple II. The standard features included are impressive, but by no means complete. My applications are different than yours, so our systems must be configured differently. The standard 16K Apple II can do a lot of processing, but you must have a TV monitor (or modulator) to see what it's doing and a cassette unit to store what it has done. Perhaps your dealer included the cassette recorder and modulator in the price; if not, you have already started the process of accessory purchasing.

Once you have played the standard game a few times and (I hope) studied the excellent documentation supplied by Apple, you will probably be itching to begin your own applications. If you purchased your Apple II with full 48K RAM, disk drive(s), I/O cards, modem,

Survey results.

ATV Research
13th & Broadway
Dakota City NE 68731

(402)987-3371 24 hours
NO CC/M.O.-none/Cat-Free

- "Pixie-Plexer" (PXP-4500) for advanced designers, experimenters and builders desiring to work with color and/or audio as well as b/w video signals. \$24.50

- "Pixie-Verter" (PXV-2A) rf modulated oscillator \$8.50

- Video monitors.

Advanced Computer Products
1310 "B" E. Edinger
Santa Ana CA 92705

(714)558-8813 8-7 PST
All CC/M.O.-\$10.00/Cat-Free
Items guaranteed.

- 16K memory expansion kits with instructions and jumpers: NEC UPD416-1 (200 ns)—\$89.95, Toshiba 4116-4 (250 ns)—\$89.95, Hitachi 4716-4 (200 ns)—\$89.95, Mostek MK4116-2 (200 ns)—\$89.95

California Digital
4738 156th Street
Lawndale CA 90250

(213)679-9002 8:30-5 PST
MC, VISA/M.O.-none/Cat-Free
90-day guarantee

- NEC UPD416D 16K memory chip set 8/\$65

- Digicast AV/100 rf modulator \$29.95

Candex Pacific, Inc.
693 Veterans Blvd.
Redwood City CA 94063

(415)364-8427 9-6 PST
No CC/M.O.-none/Cat-none
(data free) 30-day guarantee

- Tape activator controls audio tape recorder from the game I/O connector. Can control other devices not exceeding 1/2 Amp current. Has connector for game controls or another activator. Each model addressed by a different POKE command, if multiple units are used each must be a different model. Model numbers: 100-00; 100-01; 100-02; 100-03. \$39.95

Circuit Specialists
1344 North Scottsdale Rd. (Box 3047)
Tempe AZ 85281

(800)528-1417
MC, VISA/M.O.-\$15 phone, mail-
none/Cat-Free

- Pkg. of eight 4116 16K memory chips \$159.95

- EPROMs, ICs, components.

Deltroniks
5151 Buford Hwy.
Atlanta CA 30340

(404)458-4690
MC, VISA/M.O.-none/Cat-Free
Memory chips 100 percent
guaranteed.

- 16K memory expansion package \$80., 32K \$160.

- ICs, components.

printer, etc., this article may be only of passing interest to you. I suspect (from personal experience and an informal survey of owners in our local Apple users group) that most computer hobbyists start out with a "plain Jane" system and the intention of adding hardware and accessories as interests develop and finances permit. Many of us in the latter group (you know—the ones unable or unwilling to commit several kilobucks to our initial purchase) have now reached the point of looking for ways to expand the capabilities of our systems.

Many applications require additional hardware (and software) of a specialized nature. Amateur radio, for instance, could use audio-to-digital converters, antenna rotor controls,

ASCII-to-five-level conversion, logging systems, repeater control and ac controllers, to mention only a few of the countless possibilities. Someone in the diverse group of Apple owners and accessory designers has probably worked up items that will be of direct use in your application, but where do you find out about them?

Sources of Information

Computer manufacturers publish a great deal of information about their products. Apple literature describes not only the basic system, but also numerous accessories available from dealers. You probably studied some of this literature in reaching your decision to purchase the Apple II and are already aware of most items offered by Apple. Unless your



The Heuristics SpeechLab is one of the many accessory items offered for the Apple II. (Photo courtesy of Heuristics, Inc.)

literature is quite recent, you may have missed some, since new items are continually being added to the Apple line.

Your local computer emporium can be a great source of information. Most manufacturers maintain a mailing list of dealers and send literature on new products as they become available. I'm sure your dealer would be happy to watch for product announcements of specific interest to you.

If you are fortunate enough to live in an area that has an Apple users group, much valuable information is available. Chances are some of the other members have interests similar to yours and will be willing to work together on applications. A file of literature received by various members of the group would be a good source for information on hardware and accessory items.

Magazines, newsletters and direct-mail advertising are all directed toward disseminating information about available new products. Manufacturers spend a great deal of money attempting to inform you of the items they have to offer, but obviously cannot advertise each product in every issue of every publication. Many magazines offer reader service cards, which enable you to obtain literature on specific products. If you don't see the particular company listed that interests you, a letter request will usually bring a catalog by return mail. Some companies request an SASE or small fee for their literature; this is usually noted in their advertisements.

Digital Dynamics, Inc.
310 C. Breesport
San Antonio TX 78216

- Computer canopy dust cover. Standard color walnut, other colors available. \$12.95

Digital Research Corporation (of Texas)
PO Box 401247K
Garland TX 75040

- 16K dynamic RAM chips (250 ns) 8/\$89.95
- EPROMs, ICs, components, etc.

Electronic Systems
PO Box 21638
San Jose CA 95151

- National 4116 16K RAM chips (250 ns) \$8
- 2102 1K RAM chips (450 ns) \$1.75
- Apple II serial I/O Interface—adjustable 0-30,000 baud, plugs into any peripheral connector. Includes operating software. Board only (#2) \$15, with parts (#2A) \$42, assembled and tested (#2C) \$62
- Many other boards and kits.

Elektrik Keyboard, Ltd.
1920 N. Lincoln Ave.
Chicago IL 60614

- Joy Stick—Apple II. Uses everything the game I/O can control. Has four paddles, three switches, four LEDs. \$180.
- Multiplexing card. Expands socket into five sockets for attaching extra paddles, joystick, light pen.
- Travel case. Heavy duty, foam lined, metal reinforced flight case. Carries computer and two disk drives. \$199.

Godbout Electronics
Box 2355
Oakland Airport CA 94614

- Godbout 16K conversion (250 ns) \$109
- EPROMs, ICs, components, etc.

D.C. Hayes & Associates, Inc.
PO Box 9884
Atlanta GA 30319

- Micromodem II provides capabilities of communications card and acoustic coupler, plus programmable automatic dialing and answering. Plugs into Apple expansion slot, direct coupled to phone line. Under \$400.

(512)341-8782 9-5
MC, VISA/M.O.-none/Cat-Spec.
sheets free. Defective items
repaired or replaced.

(214)271-2461 8:30-5
MC, VISA, AE/M.O.-\$10/Cat-Free
90-day money-back guarantee

(408)226-4064 24 hours
MC, VISA/M.O.-none/Cat-Free
Lifetime guarantee

(312)751-1555 10-8 M-TH, 10-6 F, S
No CC/M.O.-check/Cat-available
soon

(415)562-0636 24 hours
MC, VISA/M.O.-\$15/Cat-Free
1 year against defects in
materials or workmanship

Sold only through Apple dealers.

Henwood Enterprises, Inc.
1833 E. Crabtree Dr.
Arlington Heights IL 60004

- Wrapple dust cover for Apple II \$8.95
- Wrapple II dust cover for Apple II plus 1 or 2 Disk IIs on top \$9.95

Heuristics, Inc.
900 San Antonio Rd.
Los Altos CA 94022

(800)323-7360 9-5 CST
MC, VISA, AE/M.O.-none/Cat-none
1 year against material or labor
defects.
(415)948-2542 8-5 PST
CC accepted/M.O.-none/Cat-none
1 year guarantee

- Model 20A 32 word SpeechLab for Apple includes ROM-based software, extensive manual. Applications include voice control games, data entry, research, etc., \$189
- Microphone (noise cancelling) NC-2 \$85

Integrated Circuits Unlimited
7889 Clairemont Mesa Blvd.
San Diego CA 92111

(800)854-2211 (Cal. 800-542-6239)
24 hours MC, VISA, AE/M.O.-none
Cat-Free "Unlimited guarantee"

- 4116 16K RAM chips \$11.50
- ICs, components, video monitors, etc.

Interactive Structures, Inc.
Suite 204, Science Center
3401 Market Street
Philadelphia PA 19104

(215)382-8296 9-5 EST
?CC/M.O.-none/Cat-Free
1 year guarantee

- AI-02 analog data acquisition system. Approx. \$210
- AO-03 digital to analog board. Available soon, price TBA
- VIP-4 video interface. Available soon, price TBA
- EC-07 editing console. Available soon, price TBA
- SI-01 serial interface. Available soon, price TBA

International Electronics Equipment Corp.
PO Box 522542
Miami FL 33152

(305)595-2386
MC, VISA/M.O.-none/Cat-none
Guaranteed working

- Apple interface for Okidata CP110 printer (must be used in conjunction with Apple's interface board). \$100
- Okidata CP110 \$650

Ithaca Intersystems
PO Box 91
Ithaca NY 14850

(607)257-0190 9-5 EST
MC, VISA (4 percent surcharge)
M.O.-none/Cat-Free 100 percent
lifetime guarantee for chips.

- Hitachi 16K memory expansion set \$140 (also available through many retail dealers).

Jameco Electronics
1021 Howard Ave.
San Carlos CA 94070

(415)592-8097 8-5 PST
No CC/M.O.-\$10/Cat-41¢ stamp
90-day warranty

- UPD416 (MK4116) 16K RAM chips \$14.95
- EPROMs, ICs, components

Microproducts
2107 Artesia Blvd.
Redondo Beach CA 90278

(213)374-1673 8-5 PST M-F
No CC/M.O.-none/Cat-Free
Guarantee offered

- Centronics 779/SWTP PR40 printer interface (MP7101-2) \$49.95
- General-purpose 8 bit parallel output port card (MP7101-3) \$44.95
- EPROM programmer for 5 volt 2K EPROMs (MP8102-1) \$99.95
- EPROM socket adapter adapts 5 volt EPROMs to Apple ROM sockets. (MP8105-1) \$14.95
- Apple II to Superkim downloading card with cable and connector (MP9102-2) \$74.95

Mikos
419 Portofino Drive
San Carlos CA 94070

(415)592-1800 8:30-5 PST
MC, VISA/M.O.-\$10 (CODs and
CC)/Cat-Write Items guaranteed

- Hitachi 2114 (250 ns) \$7.99
- National 2114 (450 ns) \$7.25
- 2102 AN-ZL (250 ns) \$1.60
- 2102 AN-4L (450 ns) \$1.25
- Full line of SSM, Wameco and CCS boards and kits.

Dan Paymar
PO Box A-133 C.S. 6800
Costa Mesa CA 92627

No Phone Orders
?/?/?
90-day replacement guarantee

- Lowercase adapter—hardware modification that allows a program to display lowercase characters on the monitor, also adds some symbols to make complete 96 character ASCII set. (Peripherals Unlimited text editor/word processor can be ordered or converted for use with the LCA) \$49.95

Survey

This survey was undertaken with a primary motive in mind—I was interested in some accessory items for my Apple II and wanted to see what was available and from whom. It occurred to me that other Apple owners might be in the same situation, thus this article.

I have attempted to provide a reasonably compact and complete list of hardware and accessory items most likely to be added by the hobbyist with a relatively bare Apple II. I made no attempt to locate all items compatible with RS-232, current loops, parallel and serial ports, etc.—the list could be endless! I included only those items advertised as being designed specifically for the Apple II. Since information on products manufactured by Apple Computers, Inc., should be readily available to all owners, I did not include these in this listing.

It should be emphasized this article is in no way intended to duplicate the advertising efforts of any supplier; it merely provides a compact listing of items and sources from which you can obtain specific information regarding them. I have attempted to answer for you the same kinds of questions we all have when dealing with any supplier.

Survey Procedure

A questionnaire was sent to as many sources as I could locate from magazine ads, direct-mail fliers and catalogs. As mentioned earlier, I included only those suppliers indicating hardware or accessories for the Apple II.

Forty-five questionnaires were mailed, and 27 were returned within four weeks... a response rate of 60 percent. Much supplementary information in the form of literature sheets, catalogs and product information was received and used to provide the information contained in the listings.

Certainly there are suppliers not mentioned in this article for various reasons—questionnaires not returned, names and

ComputerCity

When the people
behind the products count!

(Formerly the CPU Shop)



As the CPU Shop, we have been dedicated to meeting the needs of the microcomputer user. The success of the CPU Shop has led to ComputerCity—the merging of our manufacturing, wholesale and mail order divisions with our rapidly expanding retail outlets to provide the increased products and services the microcomputer consumers of today and tomorrow want—and need. We remain dedicated to providing the same service, technical assistance and fair pricing you've come to expect from the CPU Shop.

David C. Lourie
David C. Lourie, President

ComputerCity Sampler Disk Drives

When you're ready to add disk storage to your TRS-80*, we're here to help. Our CCI-100™ and -200™ drives offer more capacity than Radio Shack 35-Track (85K Bytes) drives. These drives are fully assembled, tested and ready to plug-in the moment you receive them. They can be intermixed with each other and Radio Shack drives on the same cable. 90 day warranty.

CCI-100™ 40 Track (102K Bytes) **\$399.00** CCI-200™ 77 Track (197K Bytes) **\$675.00**

Printers

Letter Quality High Speed Printer

NEC Spinwriter: Includes TRS-80* interface software, quick change print fonts, 55 CPS, bidirectional, high resolution plotting, graphing, proportional spacing and tractor feed assembly. 90 day warranty **\$2979.00**

Also: Centronics, Paper Tiger, HI Plot Digital Plotter

16K Memory Up-grade Kits

Fast and ultrareliable **\$99.00**

DISK OPERATING SYSTEMS

NEWDOS by Apparat† **\$49.95**

NEWDOS "PLUS" by Apparat† **\$99.95**

DOS 3.0 by the original author of 2.1 **\$49.95**



DISKETTE TRS-80*

BUSINESS SOFTWARE BY SBSG

Free enhancements and upgrades to registered owners for the cost of media and mailing. 30 day free telephone support. User reference on request.

Fully Interactive Accounting Package: General Ledger, Accounts Payable, Accounts Receivable and Payroll. Report generating.

Complete Package (requires 3 or 4 drives) **\$475.00**

Individual Modules (requires 2 or 3 drives) **\$125.00**

Inventory II: (requires 2 or 3 drives) **\$ 99.00**

Mailing List Name & Address II

(requires 2 drives) **\$129.00**

Intelligent Terminal System ST-80 III: **\$150.00**

The Electric Pencil from Michael Shroyer **\$150.00**

File Management System: **\$ 49.00**

Budget Control Program II by CSA **\$ 49.95**

Cash Register System II by CSA **\$ 99.00**

ComputerCity

A division of CPU Industries, Inc. ✓C108
175 Main Street, Dept. K-1 Charlestown, MA 02129

Hours: 10AM - 6PM (EST) Monday - Saturday
For detailed information, call 617/242-3350
Massachusetts residents add 5% Sales Tax

* CCI-100 and -200 are ComputerCity Inc. trademarks

† Tandy Corporation Trademark † Requires Radio Shack TRSDOS*

TO ORDER CALL TOLL FREE 1-800-343-6522

Massachusetts residents call 617/242-3350

Retail Store Locations:

175 Main Street, Charlestown, MA
K Mart Plaza, Manchester, NH
50 Worcester Road (Rt. 9), Framingham, MA
165 Angell Street, Providence, RI

Visa and Master Charge accepted

Franchise and dealer inquiries invited

addresses not located in the initial search, products recently developed and marketed. If you know of (or are) a supplier not listed, please send me as much information as you can so the listings can be expanded and updated at a later time.

Listing Format

The listings that follow are set up alphabetically and contain the following information:

Name	Number and hours for phone orders
Address	Credit Cards Accepted/Minimum Order/Catalog
City, State, Zip	Guarantee (if offered)
	Terms

• Items offered (brief description and price).

Information in the listings has been taken from questionnaire responses and/or condensed from catalog descriptions provided by each supplier. Accuracy of the information is *not* guaranteed, and you should investigate further prior to actual purchase of any item described. *None* in any category indicates no information received regarding that item.

Summary

I have made no attempt to judge the quality of either products or vendors in this article. When considering the purchase of any additional items for your Apple II, you should:

1. Carefully read the description so you know exactly what you're buying.
2. Check with your local

dealer. Perhaps he has, or would be willing to get, a unit you could see prior to making your decision.

3. Ask around. Other hobbyists in the area may have dealt with the supplier involved and be able to tell you something about the quality of products available.

4. Look through your back issues of this and other

magazines. Someone may have reviewed the particular item at a time when you weren't in the market and didn't pay much attention. (If you don't find a review and decide to purchase the item, how about writing one? It's easier than you think and could help defray the cost!)

5. Don't hesitate to request more detailed information from either your dealer or the manu-

facturer. Manuals are often available separately for a nominal cost and provide more detailed information than a spec sheet or catalog description can provide.

6. Carefully read the guarantee (if one is offered) and question any provisions you don't understand.

7. Caveat emptor! (Let the buyer beware!)

Peripherals Unlimited
2633 E. 28th St. Suite 622
Signal Hill CA 90806

- Universal parallel card—intelligent I/O control, configuration of I/O can be changed to meet particular needs via user programmable driver with battery back-up. Software inc. \$179.95
- Also carries the lowercase adapter.

Powersoft, Inc.
PO Box 157
Pitman NJ 08071

(Products sold to dealers only)
Catalog on request

- Light pen (ZXX 0003)—plugs directly into game I/O connector. Supplied with demonstration software. \$34.95

Priority 1 Electronics
16723 Roscoe Blvd.
Sepulveda CA 91343

(800)423-5633 (Cal. 213-894-8171)
8-6 PST MC, VISA/M.O.-\$10/Cat-Free with order. Chips meet or exceed manufacturers specs

- 16K memory expansion kit (200-250 ns) \$69

The CPU Shop
39 Pleasant Street
Charlestown MA 02129

(617)242-3350 9-7 M-F, 9-6 Sat. EST
MC, VISA/M.O.-none/Cat-Free
90-day guarantee

- NEC UPD416D 16K (300 ns) 8/\$85
- NEC UPD416-1 16K (250 ns) 8/\$87
- NEC UPD416D-2 16K (200 ns) 8/\$89
- Dealer for complete Apple line and related software.

Tri-Tek
7808 N. 27th Avenue
Phoenix AZ 85021

(602)995-9352 9-5:30 M-F
MC, VISA/M.O.-\$10/Cat-Free

- NEC UPD416 16K (300 ns) \$18, 8/\$128
- NEC UPD416-2 16K (200 ns) \$20, 8/\$144
- IC, components.

every four years. . .

...the world's best athletes gather to compete for the coveted gold medal. This year you can more easily follow this competition with Med System's Athletic Index.

This package will allow you to search events based on country, sport, score, time, year, or the name of an athlete, or any combination of these. Year searches can be given any range. All the old records, plus trivia and brief descriptions, are at your fingertips.

The Athletic Index is now being sent with the complete statistics for all the winter competitions through the XXI Olympiad in 1976 at no extra charge. The summer statistics will be available early in 1980.

TRS-80 LII 16K cassette \$9.95
N.C. residents please add 4% tax.

Med Systems Software

P.O. Box 2674, Chapel Hill, N.C. 27514
✓ M119

BEST BUY ON COMPUTERS & DISKETTES

10 — \$37.50 + \$1.00 Shipping
50 — \$172.50 + \$1.50 Shipping
100 — \$299.50 + \$2.00 Shipping
8" BASF or Georgia Magnetics
5 1/4" Verbatim
OSI Challenger III 56K, 2-8" Drives,
Fortran, Cobol & 3 - Basics ...\$3995.00
Cromemco SYS - 3 ONLY ...\$4895.00
RS232 — DB25 Connectors
FE 2.95 MALE 1.95 HOOD .95
Call For Discounts on Additional Items



THE APCUS
RPT Box 193 U.S. 31
Berrien Springs, MI 49103
(616) 429-3034

Dealer Inquiries Invited

✓ A112



DISK OPERATING SYSTEM KMMM

INSIST ON THE ORIGINAL
(BECAME OPERATIONAL MID '78)

VERSIONS AVAILABLE FOR:

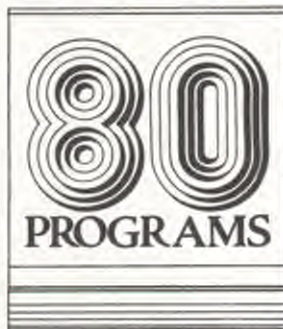
**PET KIM TIM
SYM AIM**

INCLUDES DISK FILE PATCHES
FOR MICROSOFT BASIC
CALL OR WRITE FOR PRICES
AND NAMES
OF SATISFIED CUSTOMERS
✓ W36

WILSERV INDUSTRIES
P.O. BOX 115

HADDONFIELD, N.J. 08033
(609) 227-8696

YOURS FREE!!!



Here's a great invitation.

Get 80 Microcomputing for \$1.00 an issue—\$3 off the basic subscription rate—ONE-HALF the regular cover price—and get 80 Programs FREE!

It's 80 Microcomputing's gift to you as a charter subscriber—a giant book of programs for your TRS-80* . . . business, education, games and home management.

To get your FREE copy, simply enter your subscription order below. We'll mail you 80 Programs as soon as we receive your payment.

*(TRS-80 is a trademark of the Tandy Corp.)

YES! SIGN ME UP AS A CHARTER SUBSCRIBER TO 80 MICROCOMPUTING FOR JUST \$1.00 PER COPY. AND SEND MY FREE COPY OF 80 PROGRAMS WHEN YOU RECEIVE MY PAYMENT.

☐ 12 issues—\$12 (save \$12) ☐ 36 issues—\$36 (save \$36)

☐ Payment enclosed ☐ Please bill me

Bill my ☐ Visa ☐ Master Charge ☐ American Express

Card # _____ Exp. date _____

Name _____ Signature _____

Street _____

City _____ State _____ Zip _____

Canada: \$12 per year US funds. Add \$2 per year for Canadian dollars. All other foreign subscriptions: \$20 one year only, payable in US currency.

301K22

**BUSINESS REPLY CARD**

FIRST CLASS PERMIT NO. 780 FARMINGDALE NY 11737

POSTAGE WILL BE PAID BY ADDRESSEE

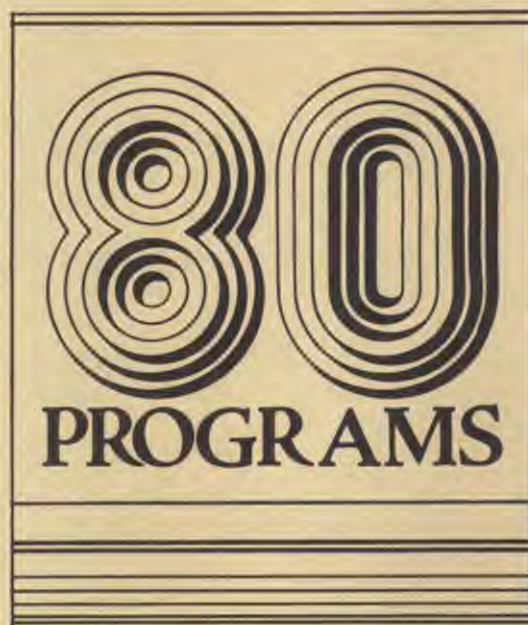


Subscription Services Dept. • P.O. Box 981
Farmingdale NY 11737

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



YOURS FREE!!



A GIANT BOOK OF 80 PROGRAMS FOR THE TRS-80* AS A FREE GIFT WITH YOUR CHARTER SUBSCRIPTION TO 80 MICROCOMPUTING, AN ALL NEW MICROCOMPUTER MAGAZINE FOR THE TRS-80 OWNER AND USER

That's right. You can receive a giant book of programs for your TRS-80 and have the distinction of being a charter subscriber to the largest magazine published on the TRS-80.

80 MICROCOMPUTING contains a wealth of information on business, personal and educational software. New product reviews are featured each month, along with new applications for everything from text editing to music.

Subscribe today and take advantage of this super charter subscription offer . . . 12 months of 80 MICROCOMPUTING for \$12 . . . (that's half the newsstand price)! Plus, if you subscribe now, we will send you FREE OF CHARGE a giant book of 80 PROGRAMS for your TRS-80.

*(TRS-80 is a trademark of the Tandy Corporation.)

**YES! SIGN ME UP AS A
CHARTER SUBSCRIBER TO
80 MICROCOMPUTING FOR
JUST \$1.00 PER COPY, AND
SEND MY FREE COPY OF 80
PROGRAMS WHEN YOU
RECEIVE MY PAYMENT.**

☐ 12 issues — \$12 (save \$12) ☐ 36 issues — \$36 (save \$36)

☐ Payment enclosed ☐ Please bill me

Bill my ☐ Visa ☐ Master Charge ☐ American Express

Card # _____ Exp. date _____

Name _____ Signature _____

Street _____

City _____ State _____ Zip _____

Mail to:
80 MICROCOMPUTING
POB 981
Farmingdale NY 11737

301K33

Canada: \$12 per year US funds. Add \$2 per year for Canadian dollars. All other foreign subscriptions: \$20 one year only, payable in US currency.

The Metamorphosis of a "Custom" PET

This all-in-one design offers maximum portability in a disk-based PET.

Robert Freeman
Penn Park J-382
Morrisville PA 19067

Almost everyone is familiar with the PET computer from Commodore; it is one of the most popular "appliance-type" computers and features a built-in video display and cassette recorder. The PET uses the 6502 microprocessor and Microsoft BASIC—the fastest combination around.

But like many computer owners, I soon became impatient with the slow cassette recorder. Also, like many other computer

owners, I wanted to expand my system to include more memory, more I/O, etc. But I still wanted a single compact unit such as the original PET. That started me thinking about a "custom" PET, with a built-in floppy disk system and extra memory.

Considerations

1. I wanted to maintain the portability of my PET.
2. I wanted the disk on the front for easy access.
3. I would only use the cassette recorder occasionally once I had the disk installed.
4. I wouldn't need the PET keyboard, as I had already built

an external keyboard.

5. I needed room to mount a floppy disk drive (or drives), floppy disk controller, memory expansion, power supply for the disk drive and control boards. I needed more physical space for expansion.

I then had to consider other limitations: lack of hard cash. I could supply the effort and the metal bending, but where could I get an economical disk controller and software to run my disk? And how could I increase memory capacity for a reasonable cost?

After looking around a while, I found there wasn't much choice. The only company that

sold a separate disk controller board for the PET was CGRS Microtech, Inc., of Southampton PA. This turned out to be an excellent choice since the CGRS Microtech board (EXS100) is actually two boards in one: a disk controller and PET-to-S-100 adapter (see Fig. 1).

The board is the size of the standard S-100 card, with the disk controller (and ROM space) using the upper half of the board and the S-100 adapter for memory expansion on the lower half of the board. The cost of this card assembled and tested was \$299 for the disk controller and cassette software. Their ROM version of software (by Wilserv Industries, PO Box 115, Haddonfield NJ 08033), which I purchased, was an additional \$60 (see Photo 1).

With the CGRS Microtech S-100 memory expansion adapter, I was able to buy inexpensive memory as needed, add all kinds of extra I/O and many sophisticated types of S-100 cards and have hardware and software to support three disk drives.

With most of the pertinent facts in mind, I was now ready to start my planning and design.

Decisions, Decisions

My initial design decisions included using the CGRS controller, beginning with one disk drive, using a 5 slot (S-100) motherboard, adding 16K extra

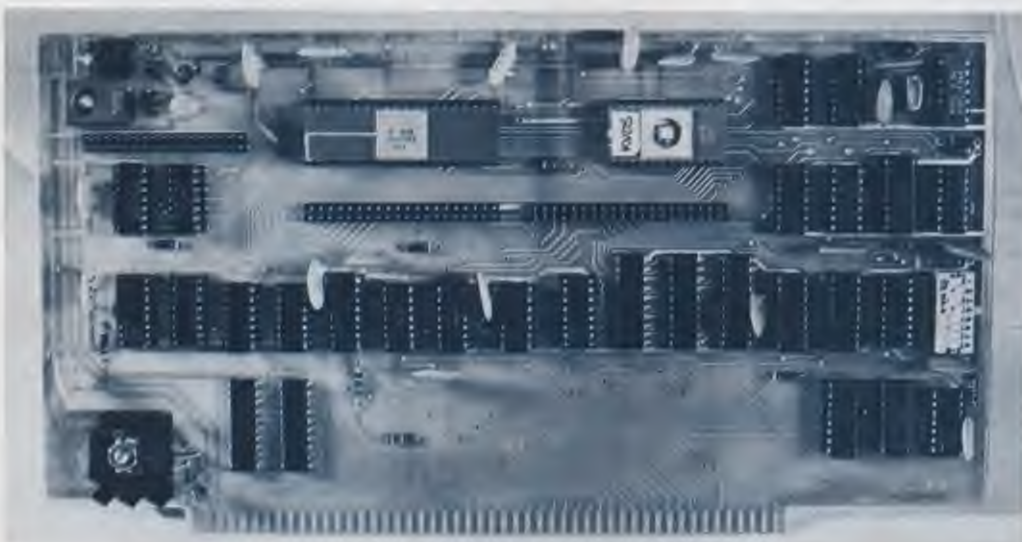


Photo 1. The CGRS Microtech disk controller board showing the PET-to-S-100 adapter and disk controller section.

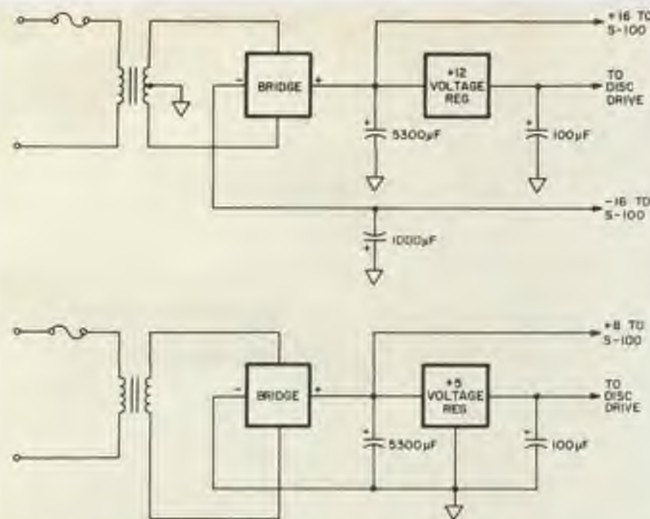


Fig. 1. Power supply for both disk and S-100. (Parts purchased from AB Computers, 115 East Stump Rd., Montgomeryville PA 18936.)

memory, using an external keyboard and eliminating the tape cassette from the front and plugging it in back when I needed it.

The next big decision I made was to eliminate the sloped front and make a new top cover for the PET, but leave the rest of the sheet metal as it was. Now, this may seem to you like a rather strange way to treat a PET, but I wanted to have the extra room.

Before making the final decision to start construction, I went to CGRS Microtech to see their complete disk system in operation. I was surprised to learn their controller card would also, with a few jumper changes, operate eight inch disks (see Photo 2) as well as the mini-disks. The system they let me use consisted of their standard disk package with two eight inch disks. I was pleased to find it simple to use and foolproof in its operation.

New Cover

I made the case out of a piece of 1/16 inch thick aluminum (27 inches wide x 29 inches long) that I cut out and bent in four places so it would fit directly onto the original PET hinge and open the same way as the original PET case opens.

Then, instead of leaving a large hole in the top between the PET and the CRT, I made a small hole to run wires down from the

CRT and a hole for a fan to draw the air through the CRT into the bottom of the case. Proper ventilation is important in the original PET. A fan is almost necessary there.

I moved the power transformer from the base to the back wall (back of PET, lower half). Then, I replaced the part of the PET that held the tape deck and keyboard with my square box. That made my PET about one inch taller. Instead of sloping down at front for the keyboard, it comes straight across and is the same size as the original PET box.

Between the main logic board and the left-hand side of the PET, there was room for a five slot S-100 motherboard (where the cassette used to be) as well as the disk controller card, memory cards and several other S-100 cards. The fan is mounted horizontally between the CRT housing and the new case to provide ventilation to all the electronics.

I already had replaced the original keyboard with a full-size keyboard, so there was no need for the PET keyboard. This left room to put three drives in the new enclosure. Right now I only have one disk drive, which is mounted horizontally so it looks better. I will mount future drives vertically, so I will have space for a total of three while still keeping the PET in one compact, portable, easy-to-move-around package.



Photo 2. Original PET with CGRS PE disk system.

Power Supply

The power supply drives the disk and the S-100 board. It requires +8 volts at 5 Amps, ± 16 volts at 3 Amps for the S-100 bus, +5 volts at 2 Amps and +12 volts at 2 Amps for the disk. I assembled the power supply with parts that were on hand or readily available for less than \$30. A complete power supply kit is available from CGRS for \$55. The power supply is mounted in the upper corner of the new box behind the Shugart drive.

Assembly

The assembly went together

well. The cables for the S-100 expansion system (Photo 3) connect to the PET memory expansion port and run underneath the PET main logic board, up alongside of the S-100 motherboard, and plug into the CGRS EXS100. Another cable connects the EXS100 to the Shugart disk drive. Two more cables connect the S-100 motherboard and the Shugart drive to the power supply.

You may notice the small circuit board in the right-hand rear corner of the PET. It has nothing to do with the disk; it is a small amplifier for sound. When software has sound built in, I don't



Photo 3. Internal assembly of Bob's PET.

FOR THE VERY BEST IN NORTH STAR COMPATIBLE SOFTWARE:

TEXT PROCESSING: 'TFS' text processing system. The most powerful word processor/output formatter available for North Star! Justifies both left and right margins. Paging, page numbering, block moves, file merges, global search and change. You can save and load text files to or from disk. Plus much, much more! 'TFS' has everything you want in a text formatter. Minimal system: 24K RAM starting at 0000H. Includes extensive user's manual — \$75.00

ASSEMBLER AND OPERATING SYSTEM: 'Arian' is the assembler/operating system you need for both the large and small jobs. Supports all wanted features, plus those special extras: user defined commands, disk based commands, transient program area, memory management, and dynamic file creation/deletion. Also, You can save and load obj./source files to and from disk. Minimal system: 24K RAM starting at 0000H. Extensive user's manual included. — \$50.00. Special utility package for 'Arian' — \$50.00

'TINY' PASCAL!: The famous Chung/Yuen 'Tiny' Pascal. A great way to write structured programs that execute up to 25 times faster than Basic. Includes source to the compiler, written in Pascal! (You can even re-compile the compiler.) Supports recursive procedures and functions as well as if... then... else... then, case, while, repeat/until, etc. (You need 24K RAM; 36 to compile the compiler). — \$40.00

INSURANCE AGENTS: We have a great package just for you! The 'CRS' client record system. A complete program system created to supply your agency with all necessary and pertinent information about your clients and prospects. This package is specifically designed with use as a marketing tool in mind! Lets you search your records any way you want and has a powerful sieve search to find correlations and exceptions (i.e., All the clients that have homeowners with you and not auto, etc.). Much, much more. Minimal system: 40K RAM starting at 2000H. Two disk drives. Holds up to 1400 names double density, 700 single density. Comes with extensive user's manual — \$250.00 Plus much more. Write for catalog or call 217-344-7596

Also, custom programming, consulting and on-site installation is available through Supersoft. Call or write us. Specify single or double density.

S81 SUPERSOFT
P.O. Box 1628, Champaign, IL 61820



Photo 4. Completed "custom" PET.

have to carry a separate amplifier and speaker with me because it's also built right into my PET.

Ease of Operation

The software from Wilserv Industries is great! You may operate it two ways; from BASIC or from its own monitor. From BASIC you can:

- Save a program
- Load a program
- Run a program
- Write a sequential data file
- Read a sequential data file
- List the disk directory
- Update a program
- Delete a program
- Initialize a new diskette
- Compress a diskette (physically recover space from a deleted program)

From the disk monitor, which is invisible to the BASIC user, you can:

- Perform all of the above BASIC commands
- Save assembly-language programs
- Load assembly-language programs
- Alter the file load point
- Move blocks of memory
- Echo the console character
- Go to any location in memory
- Move programs from disk to disk

Move Utility

Move is used to make backup diskettes or to copy programs from disk to disk. The interest-

ing point is that it will work with a single disk drive or a multiple disk-drive system. Its operation follows along logically, so it will not let you make any errors in copying.

The disk directory may be listed in short form (program names only) or long form. The long form lists the program name, number of sectors used, date the program was put on the disk, the number of program updates along with the date of the latest update, whether the program is BASIC or assembler and the starting location of the program in memory.

The disk software is IBM3740 standard and allows any IBM standard diskette (such as Radio Shack) to be read.

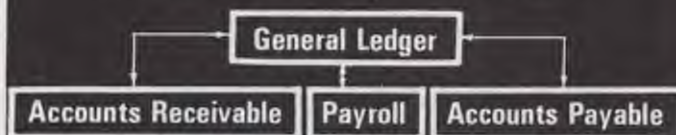
Conclusion

I now have a fantastic PET system. It is unquestionably the most versatile PET around. It wasn't as much trouble as I originally anticipated, and I had fun building it.

The real enjoyment comes from using this disk system. I have about 300 hours of use with the new system and have not had any problems. I have 12 diskettes full of programs or files (approximately 960K of storage) and have never lost a bit. It is a pleasure to load a 16 or 24K program in less than two seconds, or to see 20,830 bytes free after loading the disk software. ■

"IT PAYS FOR ITSELF . . ."

Announcing Our Integrated Accounting System



- Totally modular . . . buy only what you need
- Fast, efficient and easy to use
- Cursor control for SOL, SOROC, ADM-3, ADDS-100, Hazeltine 1500, Intertube
- 65 Programs for maximum flexibility
- Too many features to list here!

Prices: General Ledger Plus:

One package: \$225.00 Two packages: \$300.00 All four: \$350.00

Manual (for all 4 packages): \$20.00, credited towards purchase. Programs use North Star Basic, 2 disk drives (double or single density), 32K of memory. Specify video device when ordering.



ECOSOFT

P.O. Box 68602
Indianapolis, IN 46268

E34

Phone orders:
(317) 253-6828

Introducing



COMPUTER SHOPPER, the first complete publication listing business, commercial and personal computer equipment is coming this fall with the type of information you can use every month.

Just \$5 brings you a full year of late breaking ads for available equipment, software and accessories for mini, micro and big system computers AND you can run YOUR FIRST CLASSIFIED AD WITHOUT CHARGE under this Charter Subscription offer.

EACH ISSUE OF COMPUTER SHOPPER GIVES YOU:

- Ads from individuals, brokers and manufacturers, nationwide
- Categorized ads so you can find them instantly
- Large 11 by 14 easy-to-read format
- Low classified ad rates - 10¢ a word
- Short turn-around advertising time — your ad is in print in 10 days
- Free ad typesetting
- Nationwide circulation guaranteed

COMPUTER SHOPPER is YOUR place to buy or sell any computer equipment because it has been designed after extensive research into the needs and wants of America's computer buyers and sellers.

To reach more than 20,000 computer-owning firms each month, COMPUTER SHOPPER has been launched on a \$78,000 budget by Patch Publications, a proven specialist in reader service

advertising, including its flagship photographic publication, *Shutterbug Ads*.

Using in-house computer facilities and professional typesetting, Patch's experienced production team makes COMPUTER SHOPPER easily affordable for firms and individuals by using modern techniques and large-space advertising to offset normal costs.

EVEN A LIMITED-TIME COMPUTER USER can get any buy, sell or want-to-find message into this nationwide market for a most reasonable cost... only 10¢ a word.

And to prove how successful this ad can be for you, this Charter Subscription Offer includes your own complimentary classified ad. Use it to sell your used equipment or to find components you need.

Just select the correct category listed at left, include it, plus your ad wording on a separate sheet... then return it with your subscription acceptance.

DON'T MISS a single timely issue of COMPUTER SHOPPER. Send the coupon with your ad today, knowing you can cancel anytime and receive a 100% refund for all unmailed issues.



COMPUTER SHOPPER

P.O. Box F, Titusville, FL 32780
305-269-3211, 8 a.m. - 5 p.m. C160

LIST OF CATEGORIES IN COMPUTER SHOPPER

Mini Computers

Burroughs Systems
Data General Systems For Sale
Data General Systems Wanted
Data General, Software, Parts, Peripheral
Datapoint Systems
Datapoint Software, Parts, Peripheral
DEC Systems For Sale
DEC Systems Wanted
DEC Software, Parts, Peripheral
IBM Systems For Sale
IBM Systems Wanted
NCR Systems
NCR, Software, Parts, Peripheral
Misc. Minicomputers (Hardware & Software)

Micro Computers

Apple Computers For Sale
Apple Computers Wanted
Apple, Software, Peripheral
Northstar Computers

Northstar, Software, Peripheral
Ohio Scientific
Ohio Scientific, Software Peripheral
PET Computers
PET Software, Peripheral
TRS-80 Computers For Sale
TRS-80 Computers Wanted
TRS-80, Software, Peripheral
Misc. Microcomputers
Misc. Microcomputer Software, Peripheral

Peripheral & Misc. Equipment

Card Readers
Disc Drives
Line Printers
Punched Card Equipment
Tape Drives
Crt's
Misc. Equipment
Misc. Large Systems
Misc. Software
Misc. Accessories & Supplies

SPECIAL Charter Subscription OFFER Save \$5.00

☐ Yes, I want to become a charter subscriber of COMPUTER SHOPPER, the nationwide computer marketplace. Enter my Charter Subscription for the half price rate of \$5.00 for 1 year (12 issues). If I'm not totally satisfied with my first issue, I can have a full refund and I keep the first issue FREE.

Name

Address

City State Zip

☐ Payment Enclosed ☐ Master Charge ☐ VISA

Card # Exp. Date

☐ I have enclosed my complimentary classified ad.

☐ I'd like to run my ad later. Please send me a Certificate.

Mail to: **COMPUTER SHOPPER, P.O. BOX F
TITUSVILLE, FL 32780 or call 305-269-3211**

SOFTWARE FOR 1980 — AND BEYOND

A new decade begins! It is a time to take inventory of one's past and make resolutions for the future. Instant Software resolves to continue to bring you new, exciting, and useful programs. The inventory of our past accomplishments has now expanded to six pages. We have programs for the TRS-80, Levels I and II; PET; Apple II; and Heath H-8. So ring in the new with quality programs from

Instant Software™

TRS-80™

Level I and II

OIL TYCOON Avoid oil spills, blowouts and dry wells as you battle to become the world's richest oil tycoon. Two players become the owners of competing oil companies as they search for oil and control their companies. Requires a TRS-80 4K Level I or II. **Order No. 0023R \$7.95.**

HAM PACKAGE I This versatile package lets you solve many of the problems commonly encountered in electronics design. With your Level I 4K or Level II 16K TRS-80, you have a choice of:

- **Basic Electronics with Voltage Divider**—Solve problems involving Ohm's Law, voltage dividers, and RC time constants.
- **Dipole and Yagi Antennas**—Design antennas easily, without tedious calculations. This is the perfect package for any ham or technician. **Order No. 0007R \$7.95.**

ELECTRONICS I This package will not only calculate the component values for you, but will also draw a schematic diagram. You'll need a TRS-80 Level I 4K, Level II 16K to use:

- **Tuned Circuits and Coil Winding**—Design tuned circuits without resorting to cumbersome tables and calculations.
- **555 Timer Circuits**—Quickly design astable or monostable timing circuits using this popular IC.
- **LM 381 Preamp Design**—Design IC preamps with this low-noise integrated circuit.

This package will reduce your designing time and let you build those circuits fast. **Order No. 0008R \$7.95.**

Level I

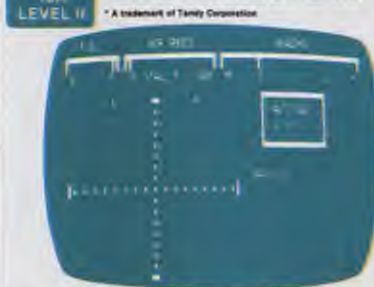
CAVE EXPLORING/YACHT/MEMORY These three programs are not only fun, but stimulating as well:

- **Cave Exploring**—Search for fabulous treasures as you explore the magic cave. For one player.
- **Yacht**—A two-player game of strategy and chance. The computer rolls the dice and keeps score.
- **Memory**—Two players can pit their memories in this program based on a popular television show. You'll need a TRS-80 with Level I and 16K. **Order No. 0010R \$7.95.**

CAR RACE/RAT TRAP/ANTIAIRCRAFT Enjoy these challenging, fun-filled programs:

- **Car Race**—You and a friend can race on a choice of two tracks.
- **Rat Trap**—Trap the rat in his maze with your two cats. For one player.
- **Antiaircraft**—Aim and shoot down the enemy airplane. Requires Level I 4K TRS-80. **Order No. 0011R \$7.95.**

Air Flight Simulation



AIR FLIGHT SIMULATION Turn your TRS-80 into an airplane. You can practice takeoffs and landings with the benefit of full instrumentation. This one-player simulation requires a TRS-80 Level I 4K, Level II 16K. **Order No. 0017R \$7.95.**

BEGINNER'S BACKGAMMON/KENO Why sit alone when you can play these fascinating games with your TRS-80?

- **Backgammon**—Play against the computer. Your TRS-80 will give you a steady, challenging game that's sure to sharpen your skills.
- **Keno**—Enjoy this popular Las Vegas gambling game. Guess the right numbers and win big. You'll need a TRS-80 Level I or II. **Order No. 0004R \$7.95.**

BOWLING Let your TRS-80 set up the pins and keep score. One player can pick up spares and get strikes. For the TRS-80 Level I 4K, Level II 16K. **Order No. 0033R \$7.95.**

KNIGHT'S QUEST/ROBOT CHASE/HORSE RACE This varied package of one-player games will give you hours of fun.

- **Knight's Quest**—Battle demons to gain treasure and become a full-fledged knight.
- **Robot Chase**—Destroy the deadly robots without electrocuting yourself.
- **Horse Race**—Place your bet and cheer your horse to the finish line.

These programs require a TRS-80 Level I 4K. **Order No. 0003R \$7.95.**

DESTROY ALL SUBS/GUNBOATS/BOMBER This package of three programs is fun for the whole family. Included are:

- **Destroy All Subs**—Hunt down enemy subs while avoiding mines and torpedoes. A one-player game.
- **Gunboats**—Try to blow the enemy's ship out of the water. For one or two players.
- **Bomber**—Carefully release your bomb to destroy the moving submarine. A one-player game.

To enjoy these programs, you'll need a TRS-80 Level I 4K. **Order No. 0021R \$7.95.**

BUSINESS PACKAGE IV Business Package IV gives you, the businessman, a superb tool to help you make those important decisions. This package includes:

- **Business Cycle Analysis**—This program isn't a crystal ball, but it can show you your business's expansion and contraction cycles. You can plot any aspect of your business on a graph and see, in black and white, just what's happening. This program will give you access to information you couldn't get before.

- **Financial Analysis**—Would you like a financial assistant who could instantly give you the figures for almost any kind of investment? Financial Analysis can handle annuities, sinking funds, and mortgages, and compute bond yield and value. You'll have the facts you need at the tips of your fingers with this program.

Included in the package is one specially marked blank data cassette for use in storing essential business data.

Business Package IV, with its combination of analytic functions and convenience features, is an invaluable asset for any businessman. All you need is a TRS-80 Level I 4K or Level II 16K. **Order No. 0019R \$9.95.**

GOLF/CROSS-OUT Have fun with these exciting one-player games. Included are:

- **Golf**—You won't need a mashie or putter—or a caddy, for that matter—to enjoy a challenging 18 holes.
- **Cross-out**—Remove all but the center peg in this puzzle, and your neighbors will call you a genius. You'll need a TRS-80 Level I 4K, Level II 16K. **Order No. 0009R \$7.95.**

BASIC AND INTERMEDIATE LUNAR LANDER Bring your lander in under manual control. The BASIC version is for beginners; the Intermediate version is more difficult, with a choice of landing areas and rugged terrain. For one player with a TRS-80 Level I 4K, Level II 16K. **Order No. 0001R \$7.95.**

SPACE TREK II Protect the quadrant from the invading Klingon warships. The Enterprise is equipped with phasers, photon torpedoes, impulse power, and warp drive. It's you alone and your TRS-80 Level I 4K, Level II 16K against the enemy. **Order No. 0002R \$7.95.**

STATUS OF HOMES/AUTO EXPENSES Two long-awaited programs that have got to save you money at work or in the home:

- **Status of Homes**—This program will allow you to keep track of all the expenses involved in building one house or an entire subdivision.
- **Auto Expenses**—Find out exactly what it costs you to drive your car or truck.

These programs require a TRS-80 Level I 4K. **Order No. 0012R \$7.95.**



Level I

BUSINESS PACKAGE I Keep the books for a small business with your TRS-80 Level I 4K. The six programs included are:

- **General Information**—The instructions for using the package.
 - **Fixed Asset Control**—This will give you a list of your fixed assets and term depreciation.
 - **Detail Input**—This program lets you create and record your general ledger on tape for fast access.
 - **Month and Year to Date Merge**—This program will take your monthly ledger data and give you a year to date ledger.
 - **Profit and Loss**—With this program you can quickly get trial balance and profit-and-loss statements.
 - **Year-End Balance**—This program will combine all your data from the profit-and-loss statements into a year-end balance sheet.
- With this package, you can make your TRS-80 a working partner. **Order No. 0013R \$29.95.**

BUSINESS PACKAGE III This package can change your TRS-80 into a full working partner for any businessman:

- **Inventory**—Maintain a computer-based inventory for a constant inventory system.
 - **Commissions and Percentages**—Let your computer figure out markup and discount calculations, sales tax and more. This is a perfect time-saving package for any small business.
- For the TRS-80 Level I 4K. **Order No. 0061R \$7.95.**

DOODLES AND DISPLAYS I Here's a mixed bag of programs that's sure to entertain:

- **Doodle Pad**—Draw pictures and save them on cassette tapes.
 - **Symmetrics**—Turn your TRS-80 into a kaleidoscope.
 - **Video Display**—Follow the bouncing cursor as your TRS-80 draws its own pictures.
 - **Mathcurves**—Bring those geometry lessons to life as the computer draws six different geometrical curves.
 - **Rugpatterns**—A never ending stream of symmetrical patterns that's sure to spark your imagination.
- All you'll need is a 16K Level I TRS-80. **Order No. 0030R \$7.95.**

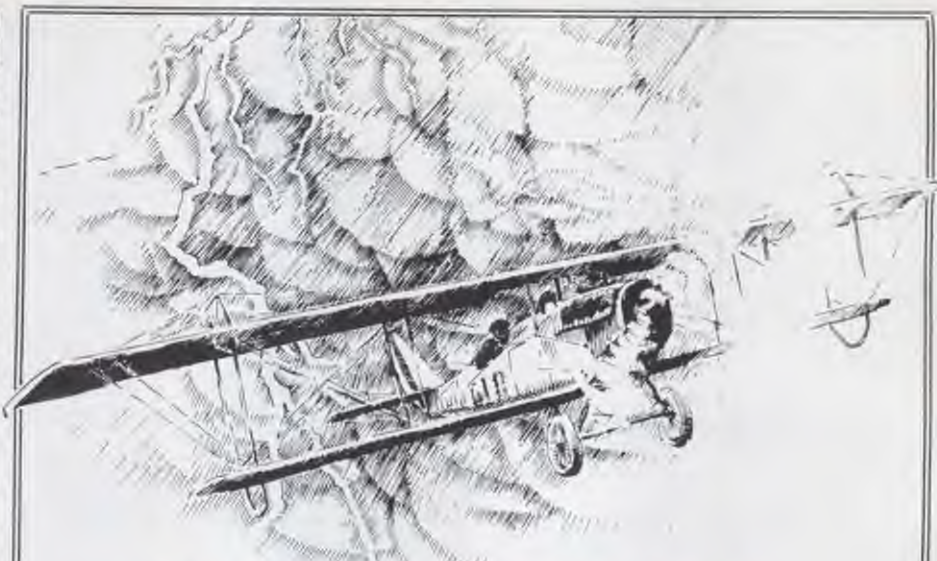
SPACE TREK III Let yourself go to the far ends of the solar system—and beyond. This package includes:

- **Stellar Wars**—Shoot down the Tie fighters and destroy the Death Star.
 - **Planetary Lander**—Land your spacecraft and plant your flag across the solar system.
- These one-player games require a TRS-80 Level I 4K. **Order No. 0031R \$7.95.**

FUN PACKAGE I Why call it "Fun Package"? Judge for yourself! This entertaining package includes:

- **Rocket Pilot**—Flying it is easy—it's the landing that's tough!
 - **Paper, Rock, Scissors**—It's the time-honored game just as you remember it, played against your TRS-80.
 - **Hex I**—Just when you master this puzzle game, the computer will increase the difficulty.
 - **Missile Attack**—Use your missiles to protect your city from jet attack.
- Requires a Level I 16K TRS-80. **Order No. 0037R \$7.95.**

TYPING TEACHER This complete seven-part package takes you all the way from initial familiarization with the keys, through typing words and phrases, to complete mastery of the keyboard. Your computer can even become a bottomless page for typing practice. It only requires a TRS-80 Level I 4K. **Order No. 0099R \$7.95.**



EVERY FLIGHT IS A SPECIAL DELIVERY

OK, Ace, you survived everything that von Richthofen and the Flying Circus threw at you. Well, that was four long years ago—and yesterday's medals don't pay the rent. But just a minute, here's an ad:

"Airmail Pilot wanted . . ."

AIRMAIL PILOT

You can almost smell the gasoline as the ground crew fuels your J-4 Jenny biplane to her 26-gallon limit. Precious mail is loaded into the cargo area, tagged for Chicago. The weatherman reports severe icing above 6,000 feet, so you know you have to keep the plane low. It will be a dangerous flight, but you knew that when you took the job. The mail must go through. So, in the tradition of Lindbergh and a hundred unsung heroes, you bravely turn your plane into the wind. The engine roars. Suddenly you're aloft on the first leg of your journey. Dayton's socked in by fog. You change your course for Lucasville. Lightning zigzags the sky. A massive, fast-moving thunderstorm forces you to land in a cornfield. As the weather clears, your plane leaps once more into the sky. But even clear skies can cause problems—violent air currents buffet your fragile wooden aircraft. Your fuel is down to two gallons as Lucasville comes into sight. You make it! Refuel and head for Chicago. But you're not out of trouble yet. There's a wind shear at the Chicago airport. You have to land in a shifting crosswind. Can you make it? **AIRMAIL PILOT** from INSTANT SOFTWARE. Unlike any other computer simulation you've ever experienced. Challenging. Difficult. But never impossible. An event in a cassette. Crash or fly, it's so realistic, you can almost feel the wind. Requires a Level II 16K. **Order No. 0106R \$7.95.**

PERSONAL FINANCE I Let your TRS-80 handle all the tedious details the next time you figure your finances:

- **Personal Finance I**—With this program you can control your incoming and outgoing expenses.
 - **Checkbook**—Your TRS-80 can balance your checkbook and keep a detailed list of expenses for tax time.
- This handy financial control for the home requires only a TRS-80 Level I 4K. **Order No. 0027R \$7.95.**

HEXPawn/SHUTTLE CRAFT DOCKING/SPACE CHASE/SEA BATTLE This four-game package is sure to provide hours of fun for the whole family.

- **Hexpaw**—Turn your TRS-80 into a model of artificial intelligence by playing a simple game.
- **Shuttle Craft Docking**—Land your shuttle craft on the starship—even through varying gravity fields!
- **Space Chase**—Seek out and destroy the enemy delta that's hidden in the star field.

• **Sea Battle**—You must find and destroy the enemy fleet.

This package requires a TRS-80 Level I 16K. **Order No. 0041R \$7.95.**

DEMO I This package is just the thing to show your friends what your TRS-80 can do. Included are:

- **Computer Composer**—Compose and play music using only a standard AM radio.
- **Baseball**—Play baseball with your computer while it does the scorekeeping.
- **Horse Race**—Place your bet and cheer your pony to the winner's circle.
- **ESP**—Test your powers of extrasensory perception.
- **Hi-Lo/Tic-tac-toe**—Guess the secret number or get three in a row.
- **Petals Around the Rose**—Can you figure out the secret behind the five dice?
- **Slot Machine**—Turn your computer into a one-armed bandit. These programs require a TRS-80 Level I 4K. **Order No. 0020R \$7.95.**

Level II

TRS-80 UTILITY I Ever wonder how some programmers give their programs that professional look? Instant Software has the answer with the TRS-80 Utility I package. Included are:

- **RENUM**—Now you can easily renumber any Level II program to make room for modification or to clean up the listing.
- **DUPLIK**—This program will let you duplicate any BASIC, assembler, or machine-language program, verify the data, and record the program on tape. You can even do Level I programs on a Level II machine. For the TRS-80 Level II 16K. Order No. 0081R \$7.95.



VIDEO SPEED-READING TRAINER As your eyes move along, reading this sentence, do you see the words like *l h i s*? Most people's reading speed is limited simply because they read individual letters or words. Now you can increase your reading speed and comprehension, and soon be reading whole words and phrases, with the Video Speed-Reading Trainer package from Instant Software.

Using the same scientific principle as the tachistoscope, a mechanical device used to flash characters or words on a screen, this three-part program will train your mind to quickly recognize numbers, words, letters, and phrases.

The program will take you step by step through a systematic training procedure. You'll start at whatever level of competency you feel is appropriate, and the computer will automatically advance you as your reading speed and comprehension increase. For the Level II 16K TRS-80 Microcomputer. Order No. 0100R \$7.95.

DEMO II Now get more fun for the bucks with this amazing package.

- **Tic-Tac-Toe**—Play an old-time favorite with three levels of difficulty.
 - **Time Trials**—Try to beat the clock as you race your car through curves, chutes, and chicanes.
 - **Maze**—One or two players can search through the maze for the secret square.
 - **Hangman**—One or two players can try to guess the secret word.
 - **Wheel of Fortune**—Choose your number, place your bet, and see if you can break the bank (for one to eight players).
 - **Hurricane**—Now you can track and monitor hurricanes anywhere in the world.
 - **Bugsy**—Can you build your Z-80 bug before the computer does?
 - **Horse Race**—Pick a sure winner and place your bet (for 1 to 100 players).
- All you'll need is a TRS-80 Level II 16K. Order No. 0049R \$7.95.

RAMROM PATROL/TIE FIGHTER/KLINGON CAPTURE Buck Rogers never had it so good. Engage in extraterrestrial warfare with:

- **Ramrom Patrol**—Destroy the Ramrom ships before they capture you.
- **Tie Fighter**—Destroy the enemy Tie fighters and become a hero of the rebellion.
- **Klingon Capture**—You must capture the Klingon ship intact. It's you and your TRS-80 Level II 16K battling across the galaxy. Order No. 0028R \$7.95.

DOODLES AND DISPLAYS II Wait until your children get hold of this package:

- **Doodle Pad**—Draw pictures and save them on cassette tapes.
 - **Symmetrics**—An electric kaleidoscope that changes from black to white and back again. It's almost hypnotic!
 - **Drawing**—Like Doodle Pad, but for the serious artist. Over 40 user commands!
 - **Random Pattern Display**—The computer does the drawing, but those with itchy fingers can tamper.
 - **Mathcurves**—Bring those geometry lessons to life. Six different geometrical curves on the screen of your TRS-80.
 - **Rugpatterns**—Yes, it does design rug patterns; and with a choice of user or computer control, it can do a whole lot more.
- For the Level II 16K TRS-80. Order No. 0042R \$7.95.

DEMO III This is the biggest package that Instant Software has ever released. Just look at what's included:

- **Race 1**—Careen around the race course as you try to beat the clock.
 - **Target UFO**—Destroy all the invading UFOs to rack up a big score.
 - **Life**—Experiment with this simulation of the life cycle of a colony of bacteria.
 - **Phone Number Converter**—Change those hard-to-remember 7-digit phone numbers into easily remembered words.
 - **Biorhythm**—You or your friends can see your biorhythm curves whenever you want.
 - **Graphics Program**—This program will really show you what your TRS-80's graphics display can do.
 - **Race 2**—Our racing game simulation for the more experienced driver includes a choice of five different tracks.
 - **Horse Race**—Up to nine players can bet on and enjoy our most entertaining horse race program.
 - **Drawing Board**—Draw pictures or messages and store them in memory or on cassette tape with this easy-to-use program.
 - **24-Hour Clock**—Transform your computer into an accurate digital clock.
- To enjoy this tremendous value, you'll need a TRS-80 Level II 16K. Order No. 0055R \$7.95.

HOUSEHOLD ACCOUNTANT Let your TRS-80 help you out with many of your daily household calculations. Save time and money with these fine programs:

- **Budget and Expense Analysis**—You can change budgeting into a more pleasant job with this program. With nine sections for income and expenses and the option for one- and three-month review or year totals, you can see where your money is going.
 - **Life Insurance Cost Comparison**—Compare the costs of various life insurance policies. Find out the difference in price between term and whole life. This program can store and display up to six different results.
- All you need is TRS-80 Level II 16K. Order No. 0069R \$7.95.

FINANCIAL ASSISTANT Compute the figures for a wide variety of business needs. Included are:

- **Depreciation**—This program lets you figure depreciation on equipment in five different ways.
 - **Loan Amortization Schedule**—Merely enter a few essential factors, and your TRS-80 will display a complete breakdown of all costs and schedules of payment for any loan.
 - **Financier**—This program performs thirteen common financial calculations. Easily handles calculations on investments, depreciation, and loans.
 - **1% Forecasting**—Use this simple program to forecast sales, expenses, or any other historical data series.
- All you need is a TRS-80 Level II 16K. Order No. 0072R \$7.95.

MODEL ROCKET ANALYZER AND PRE-FLIGHT CHECK Let your TRS-80 help you enjoy the fast-growing hobby of model rocketry. The complementary programs included are:

- **Model Rocket Flight History Prediction**—This program will compute the flight characteristics for almost any model rocket. Engine and body tube data included covers Estes, Centuri, Flight Systems, A.V.I. Astroport, C.M.R., and Kopter products.
 - **Weather Forecaster**—Before you launch your rocket, get an up-to-the-minute weather forecast. Just enter your location, elevation, average temperatures for January and July, and barometric pressure. You'll be the short-range weather forecaster for your area.
- For a successful launch, you'll need TRS-80 Level II 16K. Order No. 0024R \$7.95.

CARDS This one-player package will let you play cards with your TRS-80—talk about a poker face!

- **Draw and Stud Poker**—These two programs will keep your game sharp.
 - **No-Trump Bridge**—Play this popular game with your computer and develop your strategy.
- This package's name says it all. Requires a TRS-80 Level II 16K. Order No. 0063R \$7.95.

PERSONAL BILL PAYING

NOTE: This package can take the headaches and/or penalties out of paying your bills.

In a business office the accounts payable (bills) are usually paid on or immediately before their due date. That way, the payer gets the fullest use of his money without incurring penalties for being behind in paying his debts. Now you can take advantage of this system for your monthly bills, letting your TRS-80 do all the drudgery and record keeping.

This useful package provides a computerized list of all your bills and payments. You can access as many as 22 accounts, all of which can be named—up to 15 characters per name. Each account is listed by number, amount owed, due date, and present activity.

Don't confuse this system with a "checkbook" program. The functions of this package are threefold: (1) to monitor your bills; (2) to order payments most effectively; and (3) to make historical comparisons of individual accounts or specific months.

After you load the program, it displays a menu of 11 activities. They include:

- Build and Maintain Files
- List All Accounts
- List Current Accounts
- Make Payment(s) to Account
- Enter New Bill to Account
- Display Payment History of Individual Account (includes date paid, check number, and 12-month total)
- Display Payment History of Selected Month
- Delete Account
- Delete Prior Month's Payment
- Save File on Tape
- Input File from Tape

After you have updated the records by entering new bills, paying bills, or changing the accounts, you can save all the information on data tape. This data tape will then be input for the next time you use the package. Maybe it can't make paying bills all fun and games, but it should relieve some of the agony. Level II 16K required. Order No. 0103R \$7.95.

Level II

SPACE TREK IV Trade or wage war on a planetary scale. This package includes:

- Stellar Wars**—Engage and destroy Tie fighters in your attack on the Death Star. For one player.
- Population Simulation**—A two-player game where you control the economy of two neighboring planets. You decide, guns or butter, with your TRS-80 Level II 16K. **Order No. 0034R \$7.95.**

TEACHER Now you can have the benefits of computer-assisted instruction right in your own home. The programs allow you to input any number of questions and answers. Using this data, the computer will prepare several types of tests, quiz students, provide up to three "hints" per question—even offer graphic rewards for younger children, all at the user's discretion. Perfect for parents, teachers, or anyone faced with learning a lot of material in the shortest possible time. Furnished with blank data cassette.

Teacher requires a 16K Level II TRS-80. **Order No. 0065R \$9.95.**

TRS-80 UTILITY II Let Instant Software change the drudgery of editing your programs into a quick, easy job. Included in this package are:

- CFETCH**—Search through any Level II program tape and get the file names for all the programs. You can also merge BASIC programs with consecutive line numbers into one program.
 - CWRITE**—Combine subroutines that work in different memory locations into one program. This works with BASIC or machine-language programs and gives you a general checksum.
- This package is just the thing for your TRS-80 Level II 16K. **Order No. 0076R \$7.95.**

Santa Paravia and Fiumaccio

Buon giorno, signore!

Welcome to the province of Santa Paravia. As your steward, I hope you will enjoy your reign here. I feel sure that you will find it, shall we say, profitable.

Perhaps I should acquaint you with our little domain. It is not a wealthy area, signore, but riches and glory are possible for one who is aware of political realities. These realities include your serfs. They constantly request more food from your grain reserves, grain that could be sold instead for gold florins. And should your justice become a trifle harsh, they will flee to other lands.

Yet another concern is the weather. If it is good, so is the harvest. But the rats may eat much of our surplus, and we have had years of drought when famine threatened our population.

Certainly, the administration of a growing city-state will require tax revenues. And where better to gather such funds than the local marketplaces and mills? You may find it necessary to increase custom duties as well as tax the incomes of the merchants and nobles. Whatever you do, there will be far-reaching consequences... and possibly an elevation of your noble title.

Your standing will surely be enhanced by building a new palace, or perhaps a magnificent *cattedrale*. You will do well to increase your landholdings, if you also equip a few units of soldiers. There is, alas, no small need for soldiery here, for the crafty Baron Peppone may invade you at any time.



To measure your yearly progress, the official mapmaker will draw you a *mappa*. From it you can see how much land you hold, how much of it is under the plow, and how adequate your defenses are. We are unique in that here, the map IS the territory.

I trust that I have been of help, signore. I look forward to the day when I may address you as His Royal Highness, King of Santa Paravia. *Buon fortuna*, or, as you say, "Good luck." For the TRS-80 Level II 16K. **Order No. 0043R \$7.95.**

PET

PERSONAL WEIGHT CONTROL/BIORHYTHMS Let your PET help take care of your personal health and safety:

- Personal Weight Control**—Your PET will not only calculate your ideal weight, but also offer a detailed diet to help control your caloric intake.
- Biorhythms**—Find out when your critical days are for physical, emotional, and intellectual cycles.

You'll need only a PET with 8K memory. **Order No. 0005P \$7.95.**

CASINO I These two programs are so good, you can use them to check out and debug your own gambling system!

- Roulette**—Pick your number and place your bet with the computer version of this casino game. For one player.

•**Blackjack**—Try out this version of the popular card game before you go out and risk your money on your own "surefire" system. For one player. This package requires a PET with 8K. **Order No. 0014P \$7.95.**

MORTGAGE WITH PREPAYMENT OPTION/FINANCIER These two programs will more than pay for themselves if you mortgage a home or make investments:

- Mortgage with Prepayment Option**—Calculate mortgage payment schedules and save money with prepayments.
- Financier**—Calculate which investment will pay you the most, figure annual depreciation, and compute the cost of borrowing, easily and quickly.

All you need to become a financial wizard with an 8K PET. **Order No. 0006P \$7.95.**

CASINO II This craps program is so good, it's the next best thing to being in Las Vegas or Atlantic City. It will not only play the game with you, but will also teach you how to play the odds and make the best bets. A one-player game, it requires a PET 8K. **Order No. 0015P \$7.95.**

TREK-X Command the Enterprise as you scour the quadrant for enemy warships. This package not only has superb graphics, but also includes programming for optional sound effects. A one-player game for the PET 8K. **Order No. 0032P \$7.95.**

CHECKERS/BACCARAT Play two old favorites with your PET.

- Checkers**—Let your PET be your ever-ready opponent in this computer-based checkers program.

•**Baccarat**—You have both Casino- and Black-jack-style games in this realistic program. Your PET with 8K will offer challenging play anytime you want. **Order No. 0022P \$7.95.**

DOW JONES Up to six players can enjoy this exciting stock market game. You can buy and sell stock in response to changing market conditions. Get a taste of what playing the market is all about. Requires a PET with 8K. **Order No. 0026P \$7.95.**

TANGLE/SUPERTRAP These two programs require fast reflexes and a good eye for angles:

- Tangle**—Make your opponent crash his line into an obstacle.

•**Supertrap**—This program is an advanced version of Tangle with many user control options. Enjoy these exciting and graphically beautiful programs. For one or two players with an 8K PET. **Order No. 0029P \$7.95.**

PET**

MIMIC Test your memory and reflexes with the five different versions of this game. You must match the sequence and location of signals displayed by your PET. This one-player program includes optional sound effects with the PET 8K. Order No. 0039P \$7.95.

PENNY ARCADE Enjoy this fun-filled package that's as much fun as a real penny arcade—at a fraction of the cost!

- Poetry**—Compose free verse poetry on your computer.
- Trap**—Control two moving lines at once and test your coordination.
- Poker**—Play five-card draw poker and let your PET deal and keep score.
- Solitaire**—Don't bother to deal, let your PET handle the cards in this "old favorite" card game.
- Eat-Em-Ups**—Find out how many stars your Gobbler can eat up before the game is over. These six programs require the PET with 8K. Order No. 0044P \$7.95.

ARCADE II One challenging memory game and two fast-paced action games make this one package the whole family will enjoy for some time to come. Package includes:

- UFO**—Catch the elusive UFO before it hits the ground!
- Hit**—Better than a skeet shoot. The target remains stationary, but you're moving all over the place.
- Blockade**—A two-player game that combines strategy and fast reflexes. Requires 8K PET. Order No. 0045P \$7.95.

BASEBALL MANAGER This pair of programs will let you keep statistics on each of your players. Obtain batting, on-base, and fielding averages at the touch of a finger. Data can be easily stored on cassette tape for later comparison. All you need is a PET with 8K. Order No. 0062P \$14.95.

Apple***

GOLF Without leaving the comfort of your chair, you can enjoy a computerized 18 holes of golf with a complete choice of clubs and shooting angles. You need never cancel this game because of rain. One or two players can enjoy this game on the Apple with Applesoft II and 20K. Order No. 0018A \$7.95.

BOWLING/TRIOLOGY Enjoy two of America's favorite games transformed into programs for your Apple:

- Bowling**—Up to four players can bowl while the Apple sets up the pins and keeps score. Requires Applesoft II.
- Trilogy**—This program can be anything from a simple game of tic-tac-toe to an exercise in deductive logic. For one player. This fun-filled package requires an Apple with 20K. Order No. 0040A \$7.95.

MATH TUTOR II Your Apple computer can go beyond game playing and become a mathematics tutor for your children. Using the technique of immediate positive reinforcement, you can make math fun with:

- Car Jump**—Reinforce the concept of calculating area while having fun making your car jump over the ramps.



ACCOUNTING ASSISTANT This package will help any businessman solve many of those day-to-day financial problems. Included are:

- Loan Amortization Schedule**—This program will give you a complete breakdown of any loan or investment. All you do is enter the principal amount, interest rate, term of the loan or investment, and the number of payments per year. You see a month-by-month list of the principal, interest, total amount paid, and the remaining balance.
- Depreciation Schedule**—You can get a depreciation schedule using any one of the following methods: straight line, sum of years-digits, declining balance, units of production, or machine hours. Your computer will display a list of the item's lifespan, the annual depreciation, the accumulated depreciation, and the remaining book value. This package requires the PET 8K. Order No. 0048P \$7.95.

DIGITAL CLOCK Don't let your PET sit idle when you are not programming—put it to work with these two unique and useful programs:

- Digital Clock**—Turn your PET into an extremely accurate timepiece that you can use to display local time and time in distant zones, or as a split-time clock for up to nine different sporting events.
- Moving Sign**—Let the world know what's on your mind. This program turns your PET into a flashing graphic display that will put your message across. Order No. 0083P \$7.95.

MATH TUTOR I Parents, teachers, students, now you can turn your Apple computer into a mathematics tutor. Your children or students can begin to enjoy their math lessons with these programs:

- Hanging**—Perfect your skill with decimal numbers while you try to cheat the hangman.
- Spellbinder**—Cast spells against a competing magician as you practice working with fractions.
- Whole Space**—While you exercise your skill at using whole numbers, your ship attacks the enemy planet and destroys alien spacecraft. All programs have varying levels of difficulty. All you need is Applesoft II with your Apple II 24K. Order No. 0073A \$7.95.

MORTGAGE WITH PREPAYMENT OPTION/FIN-ANCIAL (see description for PET version 0006P) This package requires the Apple 16K. Order No. 0094A \$7.95.

ACCOUNTING ASSISTANT (see the description for the PET version 0048P) This package requires the Apple 16K. Order No. 0088A \$7.95.

•**Robot Duel**—Practice figuring volumes of various containers while your robot fights against the computer's mechanical man.

- Sub Attack**—Take the mystery out of working with percentages as your submarine sneaks into the harbor and destroys the enemy fleet. All you need is Applesoft II with your Apple II and 20K. Order No. 0098A \$7.95.

DECORATOR'S ASSISTANT This integrated set of five programs will compute the amount of materials needed to redecorate any room, and their cost. All you do is enter the room dimensions, the number of windows and doors, and the base cost of the materials. These programs can handle wallpaper, paint, panelling, and carpeting, letting you compare the cost of different finishing materials. All you'll need is a PET 8K. Order No. 0104P \$7.95.

DUNGEON OF DEATH Battle evil demons, cast magic spells, and accumulate great wealth as you search for the Holy Grail. You'll have to descend into the Dungeon of Death and grope through the suffocating darkness. If you survive, glory and treasure are yours. For the PET 8K. Order No. 0064P \$7.95.

ARCADE I This package combines an exciting outdoor sport with one of America's most popular indoor sports:

- Kite Fight**—It's a national sport in India. After you and a friend have spent several hours maneuvering your kites across the screen of your PET, you'll know why!
- Pinball**—By far the finest use of the PET's exceptional graphics capabilities we've ever seen, and a heck of a lot of fun to boot. Requires an 8K PET. Order No. 0074P \$7.95.

TURF AND TARGET Whether on the field or in the air, you'll have fun with the Turf and Target package. Included are:

- Quarterback**—You're the quarterback as you try to get the pigskin over the goal line. You can pass, punt, hand off, and see the result of your play with the PET's superb graphics.
- Soccer II**—Play the fast-action game of soccer with four playing options. The computer can play itself or a single player; two can play with computer assistance, or two can play without help.
- Shoot**—You're the hunter as you try to shoot the bird out of the air. The PET will keep score.
- Target**—Use the numeric keypad to shoot your puck into the home position as fast as you can. To run and score, all you'll need is a PET with 8K. Order No. 0097P \$7.95.

MIMIC (see description for the PET version 0039P) This package requires the Apple 24K. Order No. 0025A \$7.95.

HEATH***

MENTAL GYMNASTICS Pit your mind against the challenge of these ancient games:

- Reversi**—As you and a friend or the computer place your pieces on the board, you must each try to capture your opponent's pieces. The score can fluctuate wildly, and nobody can tell who'll win until the last move.
- War**—You can play a friend or the computer in this simple yet intriguing game. The two players take turns removing pieces from one cup and placing them in the other cups. As play continues, the number of pieces decreases. The last player who has a piece to move wins the game. To enjoy these ageless games, you'll need the Heath H-8 with 8K. Order No. 0087H \$7.95.

DATA TAPES Use these high-quality leaderless data tapes to record business or personal data. Four tapes per package. Order No. 0067 \$7.95.

*A trademark of Tandy Corporation

**An trademark of Commodore Business Machines, Inc.

***A trademark of Apple Computer, Inc.

****A trademark of the HEATH Company

Total order



Darkroom Master

Unleash your PET in the darkroom.

Jeff Knapp
1823 7th Ave.
Charleston WV 25302

the process control routine for film and print developing; and the clock/timer routine, which is called by the exposure and process routines. All the routines

make extensive use of the PET BASIC GET command and the PET's real-time clock.

The control routine contained in lines 130-230 GETS the menu

choice and sends you to the appropriate section of the program. As in all sections, the GET command is used for menu choices so you do not have to

Many people who have computers and electronics for hobbies or vocations also enjoy another technical field, photography. This program for the PET allows you to combine the two fields to give you a practical application for the computer and, in addition, bring computer accuracy to the darkroom.

Darkroom Master will let you automate many of the timing functions in your black-and-white or color darkroom. With it you can control your enlarger and safelight for exposure and sequentially time the processing of your film, prints or slides.

The Software

There are four major sections to the software: the control routine, containing a menu of available functions (each function also has its own menu); the exposure control routine for enlarger and safelight operations;

Darkroom Master.

```
10 REM*****
20 REM
30 REM          DARKROOM MASTER
40 REM
50 REM          BY JEFF KNAPP
60 REM
70 REM
80 REM
90 REM*****
100 POKE59459,255:POKE59471,0:DIMP(6)
110 P(1)="*****":P(2)="*****":P(3)="*****":P(4)="*****"
120 P(5)="*****":P(6)="*****"
130 REM***** TITLE PAGE
140 PRINT"J"
150 PRINT"          DARKROOM MASTER          "
160 PRINTP(2);TAB(4);"PRESS . FOR EXPOSURE CONTROL"
170 PRINTP(3);TAB(4);"PRESS - FOR PROCESS CONTROL"
180 GETC$:IFC$=""THENGOTO190
190 IFC$="."THENGOSUB 250:GOTO 260
210 IFC$="-"THENGOTO 640
230 GOTO140
240 REM***** EXPOSURE CONTROL ROUTINE
250 PRINT"J";TAB(8);"
260 PRINT"          EXPOSURE CONTROL          "
270 RETURN
280 PRINTP(1);TAB(4);"PRESS . TO FOCUS"
290 PRINTP(2);TAB(4);"PRESS - TO SET EXPOSURE TIME"
300 PRINTP(3);TAB(4);"PRESS = TO START OVER"
310 GETA$:IFR$=""THENGOTO 310
320 IFR$="."THENGOTO 360
330 IFR$="-"THENGOTO 460
340 GOTO140
350 REM***** FOCUS ROUTINE
360 GOSUB 250
370 POKE59471,16
380 PRINTP(1);TAB(4);"
390 PRINTP(2);TAB(4);"PRESS - TO SET EXPOSURE TIME"
400 PRINTP(3);TAB(4);"PRESS = TO START OVER"
410 GETA$:IFR$=""THENGOTO 410
420 POKE59471,0
430 IFR$="-"THENGOTO 460
440 GOTO140
450 REM***** EXPOSURE ROUTINE
```


press the return key to activate the PET.

If you press the "start over" key or any illegal key, the PET will cancel the function and send you back to the control routine. All of the control keys are located at the bottom of the numeric keypad, with the exception of the space key (more about that later), so that it is easy to make entries without hunting all over the keyboard in the dark and possibly pressing the wrong button.

The exposure control routine, lines 240-630, consists of two subroutines for focusing and obtaining the actual exposure. Each has its own menu of options. The focus subroutine only turns on the enlarger; no timing is performed here. But the exposure subroutine, once it inputs your exposure time, calls the clock/timer and turns off the safelight, turns on the enlarger and starts counting until the clock matches your entry. Then it shuts down the enlarger and turns the safelight back on.

You now have the option of exposing another print (if you want to make 100 prints from the same negative), changing your exposure time, refocusing the enlarger or starting over from control and going on to process your print.

The process control routine, lines 640-1090, as written, is set up for processing black-and-white prints. I'll talk later about setting it up for processing films and color media. Upon going to the routine from control, you will be asked to enter times for developing, stop-bath time, fix time and the drain times in between steps. You can change your times once they are entered if you wish.

When you start the timing, each step is printed on the screen along with its own clock in reverse video. At the end of the timing sequence, you are asked if you want to run the same times again for processing the 100 prints you made earlier.

The clock/timer routine, lines 1100-1270, is the heart of the program. It compares your entry against the current time and takes appropriate action on the

```

460 GOSUB 250
470 PRINT$(1);TAB(21);" "
480 PRINT$(1);PRINTTAB(8); INPUT"EXPOSURE TIME";ET$
490 PRINT$(3);TAB(4);"PRESS 0 TO START/REPEAT EXPOSURE"
500 PRINT$(4);TAB(4);"PRESS . TO CHANGE EXPOSURE"
510 PRINT$(5);TAB(4);"PRESS - TO FOCUS"
520 PRINT$(6);TAB(4);"PRESS = TO START OVER"
530 GETA$:IFA$=" "THEN GOTO 530
540 IFA$="0" GOTO 580
550 IFA$="." GOTO 470
560 IFA$="-" THEN POKE 59471,0:GOSUB 250:GOTO 370
570 GOTO 140
580 TM$=ET$:P=1:T=21:TI$="000000"
590 POKE 59471,16
600 GOSUB 1100
610 POKE 59471,0
620 GOTO 490
630 STOP
640 REM***** PROCESS CONTROL ROUTINE
650 DT$="0":DR$="0":ST$="0":FT$="0":WT$="0":POKE 59471,0
660 PRINT" "
670 PRINT"  PROCESS CONTROL "
680 PRINT$(1);TAB(7);INPUT"DEVELOP TIME ";DT$
690 PRINT$(2);TAB(6);INPUT"STOPBATH TIME ";ST$
700 PRINT$(3);TAB(11);INPUT"FIX TIME ";FT$
710 PRINT$(4);TAB(8);INPUT"DRAIN TIMES ";DR$
720 PRINT$(6);"PRESS 0 TO START TIMING":PRINT
730 PRINT"PRESS - TO CHANGE TIMINGS":PRINT
740 PRINT"PRESS = TO START OVER"
750 GETA$:IFA$=" "THEN GOTO 750
760 IFA$="0" THEN GOTO 790
770 IFA$="-" THEN GOTO 660
780 GOTO 140
790 REM***** DEVELOPING ROUTINE
800 PRINT" "
810 PRINT"  PROCESS CONTROL "
820 PRINT$(1);TAB(4);"DEVELOPING TIME ":PRINT$(2);TAB(9);"DRAIN TIME "
830 PRINT$(3);TAB(6);"STOPBATH TIME ":PRINT$(4);TAB(9);"DRAIN TIME "
840 PRINT$(5);TAB(11);"FIX TIME "
850 TM$=DT$:P=1:T=20:TI$="000000"
860 GOSUB 1100
870 POKE 59471,4:FORX=1TO1000:NEXT
880 POKE 59471,0
890 TM$=DR$:P=2:T=20:TI$="000000"
900 GOSUB 1100
910 POKE 59471,4:FORX=1TO1000:NEXT
920 POKE 59471,0
930 TM$=ST$:P=3:T=20:TI$="000000"
940 GOSUB 1100
950 POKE 59471,4:FORX=1TO1000:NEXT
960 POKE 59471,0
970 TM$=DR$:P=4:T=20:TI$="000000"
980 GOSUB 1100
990 POKE 59471,4:FORX=1TO1000:NEXT
1000 POKE 59471,0
1010 TM$=FT$:P=5:T=20:TI$="000000"
1020 GOSUB 1100
1030 POKE 59471,4:FORX=1TO1000:NEXT
1040 POKE 59471,0
1050 PRINT:PRINT:PRINT:PRINT"PRESS 0 TO REPEAT":PRINT
1060 PRINT"PRESS = TO START OVER"
1070 GETA$:IFA$=" "THEN 1070
1080 IFA$="0" THEN GOTO 790
1090 GOTO 140
1100 REM***** CLOCK/TIMER ROUTINE
1110 MIN$=LEFT$(TM$,1):SEC$=RIGHT$(TM$,2)
1120 PRINT$(P);TAB(T);" "
1130 PRINT$(P);TAB(T);" "MID$(TI$,3,2);" "RIGHT$(TI$,2);" "
1140 GETA$:IFA$=" "THEN GOTO 1160
1150 GOSUB 1230
1160 IFRIGHT$(TI$,2)=SEC$ THEN GOTO 1180
1170 GOTO 1130
1180 IFRIGHT$(MID$(TI$,3,2),1)=MIN$ THEN GOTO 1200
1190 GOTO 1130
1200 PRINT$(P);TAB(T);" "
1210 PRINT$(P);TAB(T);" "MID$(TI$,3,2);" "RIGHT$(TI$,2);" "
1220 RETURN
1230 H$=TI$:IFA$=" " THEN PRINT$(P);TAB(28);" HOLD":GOTO 1250
1240 GOTO 140
1250 GETA$:IFA$=" " THEN GOTO 1250
1260 IFA$=" " THEN PRINT$(P);TAB(28);" "TI$=H$:RETURN
1270 GOTO 660
1280 END

```

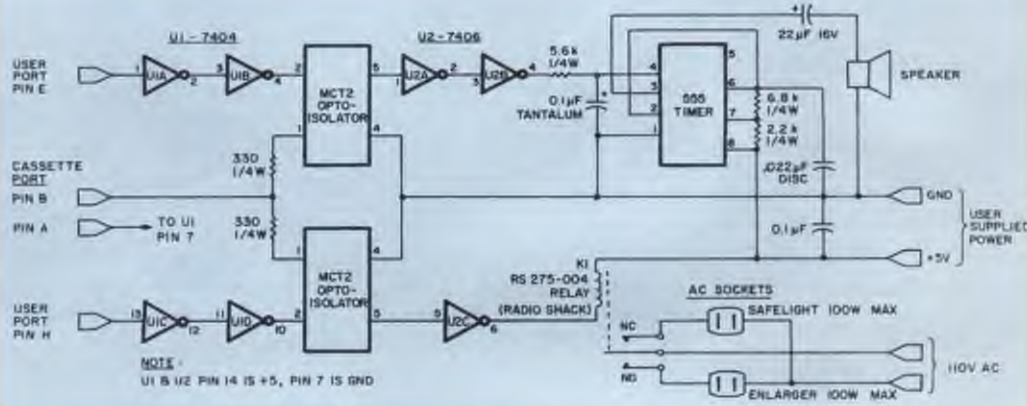


Fig. 1. Darkroom Master circuit diagram.

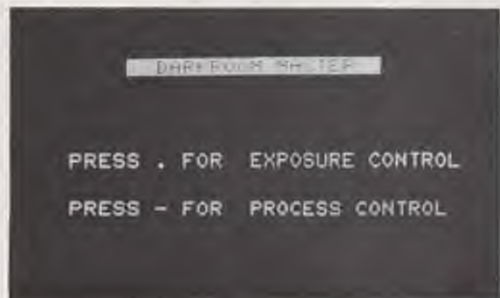


Photo 1.

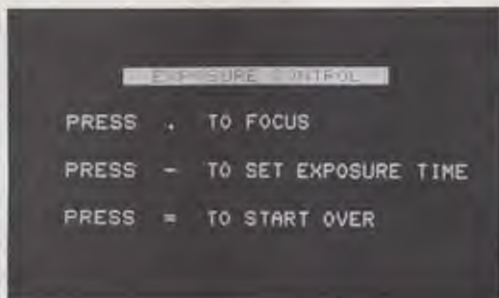


Photo 2.



Photo 3.

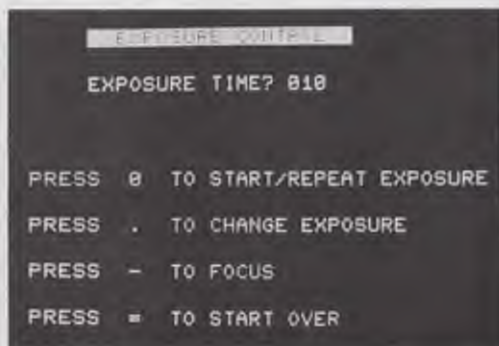


Photo 4.

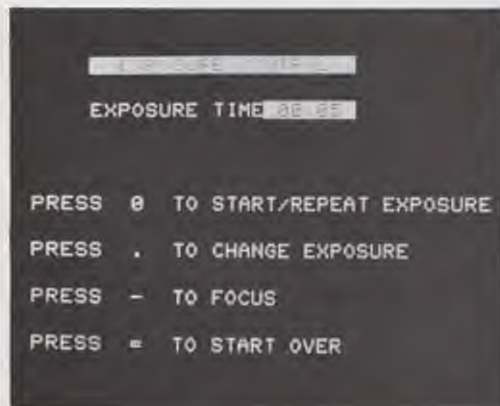


Photo 5.

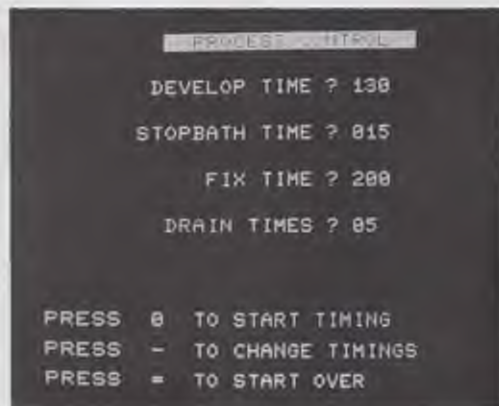


Photo 6.

result. It prints the clock at the correct place on the screen in reverse video while the clock is running, and then in normal video after the clock has stopped, going on to the next timing function. This allows you to see at a glance where you are in the timing sequence.

The Hardware

The hardware to make it work is shown schematically in Fig. 1. The upper half of the circuit is the beeper for the time-out indicator of the processing section. The PET user port, pin E, is connected through two buffers to

an optoisolator. The optoisolator's output is sent through two more buffers that gate the power to a 555 astable oscillator.

When the computer executes a POKE 59471,4, a high-level signal is present on pin E. This activates the optoisolator and the following buffers, which turn on the power to the oscillator, generating a tone. POKE 59471,0 turns off the tone.

The rest of the circuit is similar, but a relay is powered by the buffers instead. The relay contacts are connected to ac power sockets for control of the enlarger and safelight. The optoisola-

tors are there to protect the PET from the potentially dangerous 110 volts ac. Don't leave them out. This is one place where you can't skimp.

To carry this further, U1 and the optoisolators are powered by the PET through connections on the PET cassette port—pin A for the ground and pin B for +5 volts. The remainder of the circuit (U2, the 555 and the relay) are powered by a user-supplied 5 V supply. Any method of construction can be used as long as the 110 V connections are hefty enough to carry 100 Watts with no problem. Use twisted pairs

to carry the signals from the PET to your enlarger/safelight control box.

Making It Work

When the hardware is constructed and connected, plug the enlarger and safelight into the appropriate outlets and load the program. As you probably know, you must use a safelight in the darkroom, that is, a lamp with a special filter that emits light that your photo materials are *not* sensitive to. This enables you to see what you are doing without ruining the light-sensitive materials.

But where do you find an affordable 5½ x 7½ inch safelight filter for your PET? Go to your local graphic arts or printer's supply shop and purchase a sheet of Amberlith or Rubylith. These are materials manufactured by Ulano, Inc., that allow your printer to mask off portions of the artwork he is photographing to prevent the camera from "seeing" them. They work by blocking the light waves that the film is sensitive to and passing the ones the film is insensitive to.

We can put this to work in our darkroom by covering the PET screen with Rubylith if we are using orthochromatic materials (such as litho film) and by using Amberlith if we are using panchromatic materials such as enlarging papers. These products come in sheets and rolls and are intended to be stripped from the clear backing sheet for use; however, just cut out a section large enough to cover the PET screen and hold it in place with masking tape along the edges.

To keep light from leaking out, turn the brightness all the way down and keep the PET at least four feet away from any light-sensitive materials. You may have to use a double thickness of Rubylith or Amberlith. Of course, you cannot use any safelight with panchromatic sheet film or with color materials, as they are sensitive to almost all visible light wavelengths. So set up your exposure and then cover the PET with a dark cloth before bringing out those materials.

To expose a print, enter ex-

NOW... Exclusively Yours from ACS

TRS-80-DOS 3.0

Disk Operating System by the Original Author

ACS is not affiliated with Radio Shack or Tandy Corp.

☐ DOS 3.0
EFFECTIVE SEPTEMBER 1
ONLY **\$49.95**

Check these DOS 3.0 features...
that go far beyond 2.1
NO KEY BOUNCE • UPWARDS COMPATIBLE FROM 2.1 • CHECK EOF
SEEK • RE-READ • RE-WRITE • LOC • VARIABLE LENGTH RECORDS
SKIP • DISK LOGGING OF MESSAGES • BOOT • CHAIN • WRITE EOF
PURGE • SET • RESET • ROUTE • RUN & LOAD FOR 1 DRIVE SYS.
XFER • FORMAT W/O ERASE • DIR FROM BASIC • PATCH • LINK
USER DEFINED KEYS • KEY AUTO REPEAT • UPPER AND LOWER
CASE DRIVER • SHIFT LOCK • RS-232-C DRIVERS
• PAUSE • USER DEVICE CONTROL BLOCKS
• MULTI PROTOCOL COMMUNICATIONS

HARDWARE FOR TRS-80[®]

- ☐ Pertec Disk Drives FD-200 \$375.00 ea.
These are 40-track Drives that are completely compatible with the TRS-80 and Radio Shack Drives. 3.0 DOS \$20.00 extra with disk drive. Will allow Turning Diskette over and Write on other side.
- ☐ 4-Drive Cable for Pertec Drives \$35.00
- ☐ DECwriter III, 132 Character \$2500.00
110 to 9600 baud EIA tractor feed keyboard printer. This is truly the nicest printer available. (30 day delivery)
- ☐ 701 Centronics TRACTOR FEED
Bidirectional Printer \$1500.00
2½ times as fast as the Radio Shack 779 Printer, has full size 132 Char. Carriage Bell tone. Complete with Cable plug in and use. Shipped Freight COD.
- ☐ 200 ns 16K Dynamic Memory Chips for Keyboard or Expansion Interface, Lifetime Guarantee, complete \$110.00
Lifetime Guarantee. Complete with Instructions and Jumper Blocks.
- ☐ 10 Key Numerical Keypad Kit \$79.95
- ☐ TRS-80 Level II - 16k \$750.00
 - ☐ Expansion Interface \$275.00
 - ☐ RS-232-C Interface \$ 89.00

ORDER NOW AND SAVE

Just list the items you want
and mail this convenient coupon.

SOFTWARE BY ACS

- ☐ Monitor No. 3 \$29.95
Complete Machine Language Monitor for TRS-80 features:
Find, EDIT, Relocate, Symbolic Dump to Tape, etc.
- ☐ Monitor No. 4 \$49.95
All of the commands that reside in Monitor No. 3, plus:
RS-232 I/O, Disk Program I/O, Symbolic Dump to Disk for
Loading into Disk Editor/ASM., Track & Sec I/O for
modification.
- ☐ PCLEND \$15.95
Will Patch ASCII files of Basic Programs or text or DATA
FILES so that they may be loaded into the Disk Version of
the Electric Pencil for Editing purposes comes on Cassette
that will automatically create a Disk file of PCLEND.
- ☐ MAKE TAPE AND MAKE DISK
for Cassette Dealers \$69.95
These are two programs that will allow you to take any type
of Program from Disk and store it on tape for mailing
purposes. When the user receives the program in the mail
on cassette, it is loaded into the computer which will
automatically make a Disk file of the program.
- ☐ CP/M & C BASIC for the TRS-80[®]
CP/M Includes: MOVCPM, STAT, PIP, Dump, DDT, ASM
(8080), ED, plus 6 user manuals.
CP/M \$150.00
C Basic-2 Includes: XREF2, CBAS2, and manuals.
- ☐ C BASIC 2 \$99.95
- ☐ G2 LEVEL III BASIC for TRS-80[®] Special \$39.95
- ☐ TELCOM - Telecommunications for the TRS-80[®] \$29.95
Telecommunications for the TRS-80[®] allows one TRS-80[®]
to communicate with another through the RS-232-C over
the phone line.



Orders received by 6:00 p.m. shipped next
day on Master Charge, Visa, Certified
Check or Money Order. Personal Checks re-
quire 14 days to clear. No C.O.D. Collect
calls not accepted. All Hardware warranted through ACS
for 1 full year. Software guaranteed for replacement only.
Prices subject to change without notice.

**AUTOMATED
COMPUTER
SOFTWARE SERVICE**

(615) 244-2798

Division of

Computer World INC.

625 Main Street • Nashville, TN 37206

Send Check or Money Order payable to -

SOFTWARE • P.O. Box 60097 • Nashville, TN 37206

Quan.	Description	Unit Price	Total

HANDLING CHARGE \$1.50
TENN. RES. ADD 6% SALES TAX **TOTAL**

Name _____

Address _____

City _____

State _____

Zip _____

- ☐ Check
 - ☐ Money Order
 - ☐ MasterCharge
 - ☐ Visa
- Card No. _____

Exp. Date _____

posure control by pressing the decimal key (Photo 1). You can now focus by again pressing the decimal key (Photo 2). When you have focused, press the minus-sign key (Photo 3). Type in the exposure time (Photo 4). If it is less than one minute, type a leading zero. For example, for a five-second exposure, type in "05"; for a ten-second exposure, type in "10."

For an exposure of one minute or more, type in the number without a leading zero and without a colon. The computer adds the colon for you, i.e., type in "130" for one minute and thirty seconds. You must press return when entering your times for exposure and processing; all other entries are under GET command control and do not require a return.

You now have another menu to choose from. You can start the exposure, change your exposure, recheck your focus or escape back to control.

Start your exposure (Photo 5). The running clock will show in reverse video, properly formatted, at the point on the screen where you entered the exposure time. Remember that I promised you I would explain about the space bar? Here's where it comes into use.

Suppose the print you are making needs a certain area "burned in," that is, given more exposure than the rest of the print. Just press the space bar and the word "hold" will appear next to the clock. This halts the timing, freezes the clock and leaves the enlarger on, allowing you to burn in the chosen area. When you are finished burning in, press the space bar again. The "hold" will disappear and the clock will pick up from where it left off.

When the clock has finished its count, it reverts to normal video, the enlarger turns off and the safelight turns on. Your menu is still on the screen for choosing the next function. To process the print, press the "equal" sign to get back to control and the "minus" sign to go to process control.

To process the print (Photo 6), enter the times for developing, stop bath, fixing and drain. A



Photo 7.

timer is not included for washing the print because it would tie up the computer for as much as two hours, and washing a print does not require to-the-second accuracy. You can use a wall clock or your wristwatch to time the wash step (don't use an LCD wristwatch with a tritium backlight; it will fog most photo materials).

When entering times, the leading zero rule applies. If you do not wish a drain time between steps, just enter "00" when asked for that time.

As with the exposure control, the clock appears in reverse video (Photo 7), formatted, and reverts to normal video at the end of the count. You can use the hold control here also, as you may want to use hot developer or ferricyanide bleach on the print.

And in both exposure and process controls, you can repeat the timing sequence without resetting the clock (Photo 8). This is helpful if you have to batch-process some prints, such as the 100 prints from one negative I mentioned earlier. You could first expose and then process all of them.

Modifications

If you are more into color prints than black and white, it's just as easy to control the process. You will have to change the process step labels, lines 680-840. And while you are in there, add the POKE commands to turn your motorized agitator on and off with the processing steps! The same principles ap-



Photo 8.

ply with any process (such as films or litho materials); you may have to add or delete some steps and change the labels.

And to make the work easier, add an external numeric keypad for remote entry of exposure and processing times while the PET is safely away from the enlarger and the sink. Get any 16 button keypad with SPST switches and wire it as shown in Table 1. I have not tried to make a keypad remote yet, but according to what I have read this should work well.

To make the program even more useful, add routines to keep track of the number of prints processed in a gallon of developer, for converting exposure times when using variable-contrast filters and to add an A/D converter for a densitometer to let your computer calculate

the exposure times.

Conclusion

There are a lot of things you can do with the hardware and the program when not running Darkroom Master. You can switch two ac devices and use the clock routine in real-time control applications. I'll soon be moving to a new house and look forward to putting my computer to work in a practical application. The program as written runs in 3.8K of PET memory.

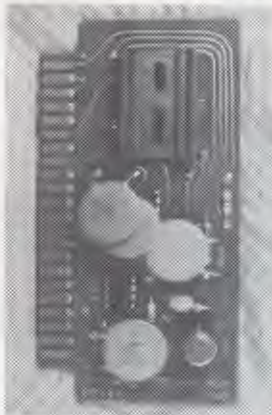
I'll be happy to answer any questions you may have or to hear about how you have used Darkroom Master; just be sure to include return postage if you want a reply.

I want to thank my wife, Millie, for typing the manuscript, and Emory Wright for the use of his PET printer. ■

From Pet Keyboard ConnectorPin	To One Side Of Switch On Keypad	The Other Side Of The Switch To The Pet Key- Board Connector Pin
G	DECIMAL POINT	10
G	0	9
G	1	7
G	2	8
H	3	7
G	4	5
G	5	6
H	6	5
G	7	3
G	8	4
H	9	3
H	9	3
H	MINUS	9
H	EQUALS	10
C	SPACE	9
F	ENTER	5

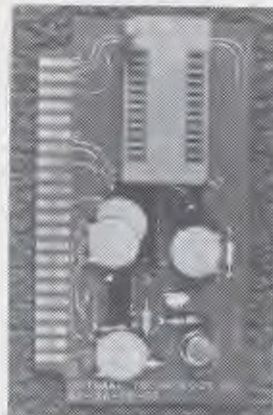
Table 1.

EPROM PROGRAMMERS



EP-2A SERIES

- PROGRAMS 2708 and 2716 EPROMS
- Price \$59.95 Assembled and Tested
- Kit price \$49.95
- Includes Connector



EP-2A-78 SERIES

- PROGRAMS 2708, 2716, 2758, TMS 2716 and TMS 2532 EPROMS
- TEXTTOOL ZERO FORCE SOCKET
- Price \$79.95 Assembled and Tested
- Includes Connector

Software available for the Rockwell AIM-65, MOS Technology KIM-1, Synertek SYM-1, Motorola D2, RCA VIP and many other single board computers that use the 6502, 6800, 8080/85, Z-80, 1802, F-8 and 2650 CPU's. Stock. Specify one set of software.

Optimal Technology Inc.

✓ 010 Blue Wood 127

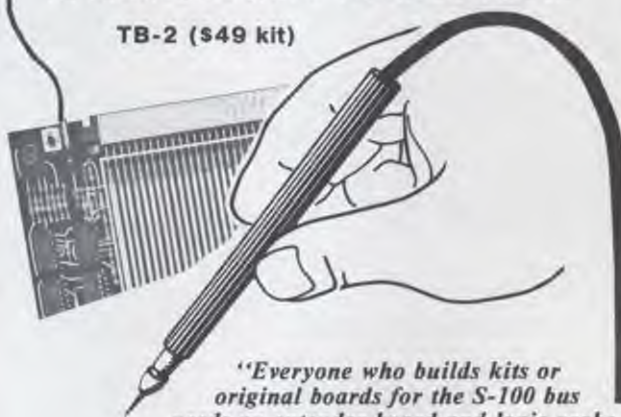
Earlysville, VA 22936 U.S.A.

Phone (804) 973-5482

MULLEN Computer Products EXTEND YOUR MICRO

S-100 EXTENDER/LOGIC PROBE
for checking out your S-100 buss computer.

TB-2 (\$49 kit)



"Everyone who builds kits or original boards for the S-100 bus needs an extender board and logic probe. This is a fine combination. I only wish I had mine two years ago."

Robert L. Leffert
Kilohaud Microcomputing
August 1979

S-100 CONTROL BOARD a simple to use interface board for all S-100 buss computers. Let your computer listen to the



outside world thru 8 opto-isolated inputs, make program decisions, and issue open/close orders to 8 reed relays. Complete programming and operation instructions included. If you have a higher power application we offer a 500 watt AC **POWER MODULE** (\$15 each).

CB-1 (\$129 kit) (\$179 assm/tested)

H8* EXTENDER BOARD lets H8 owners troubleshoot their boards faster and easier.

H8* is a trademark of Heath Company



Each board can be extended above the computer for complete access to all circuits and components.

HTB-0 (\$39 kit)

✓ M32

MULLEN Computer Products

BOX 8214, HAYWARD, CA 94544, OR PHONE (415) 783-2866.
VISA/MASTER CHARGE ACCEPTED.

PLEASE ORDER KITS BY NAME (H8 OR S-100).
NO CHARGE FOR SHIPPING WHEN PAYMENT IS INCLUDED.
CALIFORNIA RESIDENTS ADD TAX.

Order direct or contact your local computer store.



**SAVE!!
TRS-80**

**10, 15
Percent
and More!**

on computers, peripherals, software and other Radio Shack® products.

Offered Exclusively By

Pan American Electronics, Inc. A **Radio Shack**
Authorized Sales Center

1117 CONWAY MISSION, TEXAS 78572

East 212/283-0543 North Central 312/666-6098

West 213/564-5463 South Central 512/581-2765

✓ R34

(main telephone number)



NO TAXES on out-of-state shipments.
FREE delivery available on minimum orders.
WARRANTIES honored by Radio Shack®.



RECYCLE(D) COMPUTERS

BUY ☆ SELL ☆ SWAP

Hardware & Software

NEW PRODUCT ANNOUNCEMENTS

32 pages or more

Mailed 1st Class every 3 Weeks

1yr. (18 issues) ☆ \$3.75

ON LINE

✓ 02

Dave Beetle, Publisher Established 1975

24695 Santa Cruz Hwy. • Los Gatos, CA 95030

THE BEST WAY TO DETERMINE IF ON LINE CAN BE OF VALUE TO YOU IS TO TRY A

FREE SAMPLE ISSUE

SUPERBRAIN™ in stock!

This is the most cost-effective computer system available. **FREE DISKETTES.** With every order for a SUPERBRAIN received before December 31, 1979, we will include 20 free diskettes. And don't forget — our price of \$2895.00 includes U.S. shipping.

Or, if you prefer, send \$100.00 deposit and we will ship COD, freight collect.

SUPERBRAIN \$2895.00 ppd.

BCD CLOCK— Here's a novelty item that's also practical. It's an actual clock that really tells time. Only this clock reads out in Binary Coded Decimal (BCD). Features 24 hour, 6 "digit" display. Amaze your friends — only you can read it!

BCD-1 Complete kit with instructions \$24.95

BCD-2 Wood case and plastic bezel for above \$ 5.95

APPLETIME, a Real Time Clock for the Apple II. Plugs directly into any slot and keeps time even when computer is off. Features 12/24 Hour, BCD/ASCII data format, and AC/Crystal time base selection. Includes software examples for machine language and BASIC programs. Completely assembled and tested.

APT-1 Real Time Clock \$79.95

PROTOBOARD, with over 1300 holes on 0.1 centers for designing your own circuits.

APB-1 Protoboard \$17.95

VERBATIM 5 1/4" DISKETTES
Soft-Sector Box of 10 ... \$34.50
(plastic file case included)



W29



west side electronics

P.O. Box 636, Chatsworth, CA 91311

We pay all shipping in Continental U.S.A.

Others add 10%. California residents add 6% tax.



Microcomputing

Mr. JIM ARNOLD ZERACK is the office of the world renowned DR. ANDREW GATES, D.S.P. ARNOLD has been having some nightmares lately



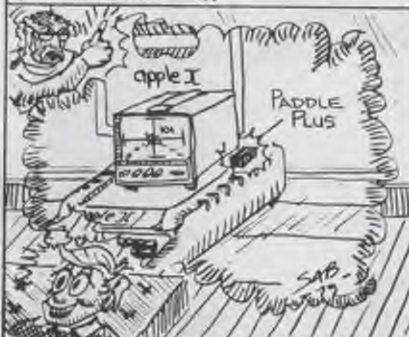
Do you feel paranoid when friends or relatives come over to play your games BUT have to wait for you to CHANGE THE PADDLES?



Ah yes, good old P.P., stemming down from BRIGHT PENS, joysticks, & paddles... covers on and off, in & out



Do solution is simple, my friend! Try new PADDLE PLUS™ and your nightmares and problems will cease!!!!



Are your goodies starting to resemble combs for YUL BRENNER?



Yes, BUCKY you CAN solve your P.P. worries with PADDLE PLUS™. This integrated plug-in extender puts YOU! in control !!!

ORDER FORM

SOFTAPE

☐ Paddle Plus @ 14.95

☐ Bright Pen @ 34.95

☐ Reset Guard @ 34.95

Name _____

Address _____

City _____

State _____ Zip _____

10432 Burbank Boulevard ✓ S90

North Hollywood, California 91601

(213) 985-5763

LIBRARY 100



The **LIBRARY 100** from **TBS** is without doubt the greatest software bargain ever. Released in November 1978, it has sold thousands in 44 countries. Written for the TRS-80, **LIBRARY 100** contains 100 programs on five tapes. Most of the programs can be run on a 4K, Level II computer. Designed to be a basic computer library, it provides a series of programs over a broad range of topics. All programs but one are written in BASIC and can easily be modified to suit your own purposes.

"The program mix is eclectic, interesting, and curious... If I had a Level II TRS-80 and one or more grade-school children, or if I were a hardcore software collector, or if I had little software and wanted to get a lot of it with a minimum of bother, I'd buy the Library 100." *Stephen Gray, Creative Computing, April, 1979.*

"... a basic computer library for the hobbyist, parent or businessman." *Kilobaud Microcomputing, December 1978.*

The programs are spread over five general categories; Finance, Education, Graphics, Home and Games. As an added bonus, the **LIBRARY 100** contains **Tiny PILOT**, a condensed version of the high level language primarily used in education. It is perfect for teachers, parents, students and sales trainees. Using only six commands, even a child could be programming in minutes. The other programs are as follows:

FINANCE: Present Value of Future Sum, Simple Interest for Days, Future Value of Present Sum, Amortization Schedule, Interest Rate-Compound Interest, Interest Rate-Installment Loan, Days Between Dates, Term of Installment Loan, Present Value of Series of Payments, Real Estate Investment Analysis, Nominal-Effective Interest, Internal Rate of Return, Future Value, of Regular Deposits, Regular Deposits for Future Value, Depreciation (Amount, Rate, Salvage Value, Schedule), Bond Present Value, Bond Yield to Maturity, Sale-Cost-Margin-Day of Week, Moving ad.

EDUCATION: Multiplication & Division, Addition, Subtraction, Fraction & Decimal, States & Capitals, States and Order of Entry, States and Date of Entry, States and Abbreviations, Inventors and Inventions, World Capitals & Countries, Urban Areas and Population, Authors & Books, Presidents and Order, States and Largest City, Base Numbers.

GRAPHICS: Front Cover, Wierd, Rat Race, Random Ad, Fireside, Left-Right Ad, Blocks, Herring, Launch, Blinker, Snoopy, Snow, Step Ad, Step Ad Two, Graphic Words, War Games.

HOME: Bartender, Nutrition, Conversion, Perpetual Calendar, Base Conversion, Calculator, Vacation Check-off List, Telecode, Message Board, Night Check-off List, Expense Account, Babysitter, Drunkometer, Remember, Christmas List, Mileage.

GAMES: Jumble, Search, Memory Quiz Letters, Sting Ray, Russian Roulette, Wheel of Fortune, Towers, Decision, Memory Quiz Numbers, Doomsday, Star Trek™ Sketch, Flipper, Life, Fifteen, Speedy, Count, Road Race, Stars, Odd One, Spy Ship, Horse Race, Scissors, Craps, Star Blazer, Tiger Shark, Unjumble, Mind Reader, Roach Race, Jumble 2, Gypsy.

The price for the **LIBRARY 100** is only \$49.50. That's less than \$.50 per program. Join the thousands of users who are already enjoying this exceptional software package. Only from **TBS**. (We are currently working on a Library for the **APPLE**.)

TBS has other great software for your TRS-80. **CHECKBOOK II**, **INFO SYSTEM**, & **EXERCISER** are general applications. **BASIC TOOLKIT**, **SYSTEM DOCTOR** & **TERMINAL CONTROL** are systems utilities. **BUSINESS MAIL LIST**, **DATA MANAGER**, **CHECK REGISTER ACCOUNTING SYSTEM** & **ANALYSIS PAD** are strong applications for business. **TBS** also has **DISK HEAD CLEANERS** for TRS-80 and **APPLE** and **GRAN MASTER DISKETTES**, the best on the market.

TBS is **YOUR COMPANY**, and to you we pledge to produce quality software at a price you can afford. The above products are available **NOW** at Computer Stores and Associate Radio Shack Stores nationwide or directly through us. For more information please contact us at the numbers below.

™ Paramount Pictures, Corporation.



THE BOTTOM SHELF, INC.

(404) 939-6031 • P.O. Box 49104-K • Atlanta, GA 30359

TRS-80 Printer Interfaces: Serial and Parallel Designs

Save \$200 or more by constructing your own interface circuits.

Rod Hallen
Road Runner Ranch
PO Box 73
Tombstone AZ 85638

The TRS-80 is a great personal computer. I don't think that it can be beat in its price class. I've had mine for several months and I really enjoy using it. It is a simple machine, yet it is capable of quite sophisticated results.

I have owned one or more microcomputers for more than two years. I use them for program development and for manuscript preparation and printing. Since both of these tasks require hard-copy facilities, the first thing I did, after buying my TRS-80, was to determine the easiest (and cheapest) way to interface a printer.

You might ask, "Is a printer really necessary to write programs?" Yes, because it is very difficult to get a good idea of the

flow of your program without being able to see it all in one place. It is also easier to find errors and make corrections. The screen is just not large enough to hold all of the information required.

The designers of the TRS-80 obviously understood the need for hard-copy capability since Level II BASIC contains the statements LPRINT and LLIST, both of which output to the printer port instead of to the screen. The Expansion Interface includes a parallel port to feed a

printer.

However, therein lies a dilemma. In order to implement hard copy on the TRS-80 as envisioned by Radio Shack, it is necessary to purchase the Expansion Interface and a line printer. This is an outlay of from 1300 to 1600 dollars, depending where you buy the printer. What about those of us who already have a printer?

I have been using the Teletype Model 43 KSR for almost a year, and I like it. It prints either 10 or 30 cps, is very quiet, has an RS-232 serial interface and has been 100 percent reliable. In addition, it prints lowercase; the Centronics 779 printer does not. This is a definite plus! Why couldn't I use it for hard copy instead of the parallel line printer that Radio Shack intended?

The Expansion Interface also provides facilities for disk drives, more memory and a second cassette recorder. I don't plan to add any of these to my unit, so I decided to design an interface to fit directly between the expansion port on the back of the TRS-80 keyboard unit and the Model 43.

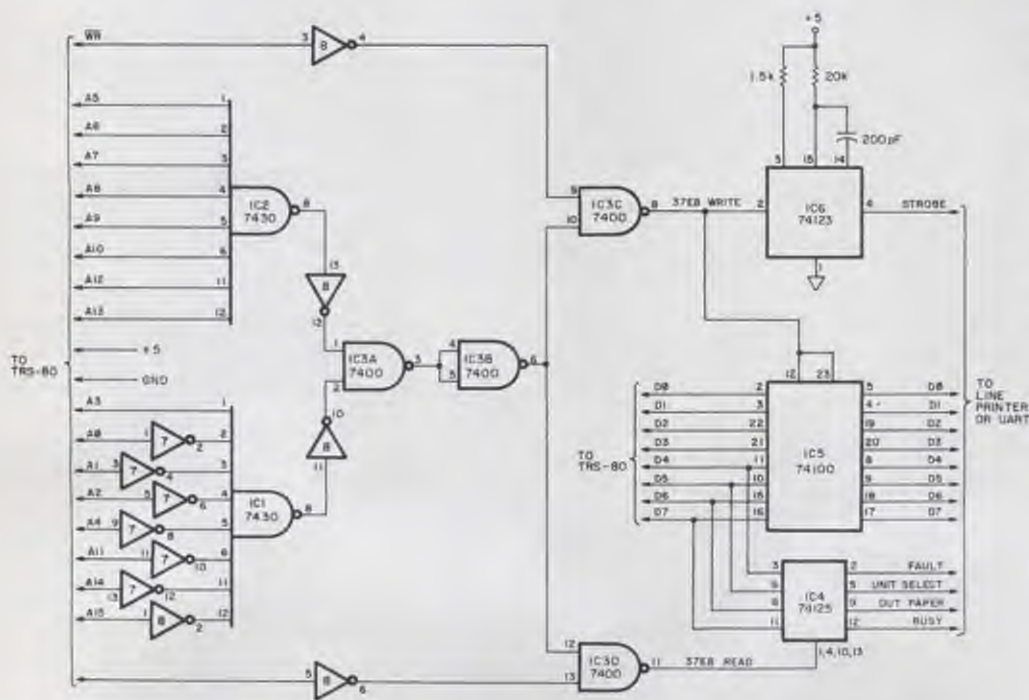


Fig. 1. Schematic drawing of the parallel interface for the TRS-80 expansion port. This will drive a Centronics 779 or similar line printer directly. Many IC substitutions are possible. IC6 could be a 74121, IC3 a 7402; IC5 could be replaced with two 74175s, and the 74125 with an 8T97 or 74367. Most of these changes would require some circuit changes.

My design was successful, as you will see, and the total cost for a serial RS-232 interface was less than \$50. If you would like to plug a parallel line printer, such as the Centronics 779, directly into the keyboard expansion port, I'll show you how to do that for less than \$5!

The Interface

First let's look at some of the requirements that our interface must meet. I was unable to obtain any information from Radio Shack on this subject, so what follows was learned by my studying the Level II print driver routine and the Expansion Interface schematic.

The printer port is addressed as a memory location instead of as an I/O port. This is called "memory-mapped I/O." The memory location used is 37E8 hex (14312 decimal), which is configured as both an input and an output port.

The print driver routine first reads the input port to see if the printer is ready to receive the next character. If it is, the character is sent to the output port, and then input port status is read continually until the printer is ready for the next character. We can't just dump text to the printer at microprocessor speed because the printer is not able to handle characters that fast.

While it is reading the printer input port the processor is also checking to see that the printer is not out of paper or hasn't some other fault. If you attempt to LPRINT or LLIST to the printer when it has a problem or is out of paper, nothing will happen. In this case it is up to you to determine what the fault is.

In order to implement a printer interface that will work with the TRS-80, you must satisfy the following requirements:

1. Decode memory address 37E8 hex.
2. Determine whether the processor desires to read or to write.
3. Gate status information onto the data bus for a READ.
4. Latch ASCII character from data bus for a WRITE.
5. Provide a WRITE strobe to UART (serial) or printer (parallel).

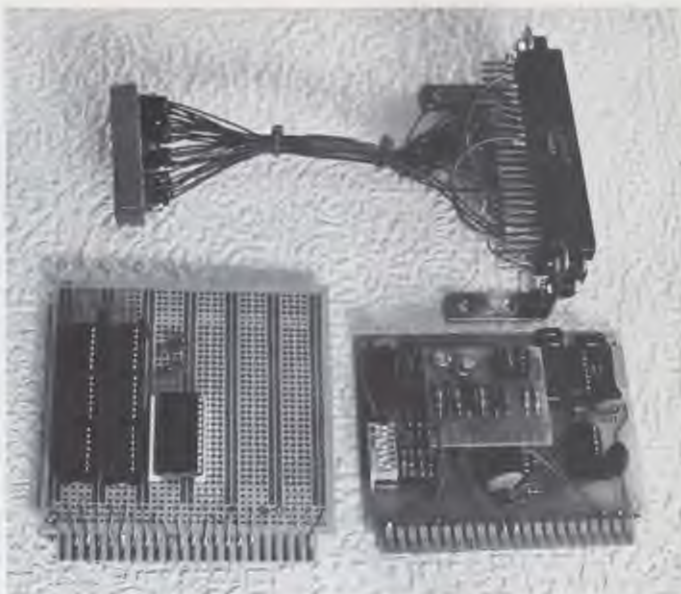
Fig. 1 shows the basic interface. This will drive a parallel printer, such as the Centronics 779, directly, and it should cost less than \$5, not including the cost of the two connectors required, to build. It can also be used to drive a UART if you intend to use a printer that has a serial RS-232 interface. I'll get to that in a moment.

First let's look at Fig. 1 and see how it satisfies the interface requirements listed above. ICs 1 and 2 are SN7430 8-input NAND gates. They are used to decode the desired address—in this case, 37E8H. I won't go into the conversion of numbers from hex format to binary format, so you'll have to take my word that 37E8H is equal to 001101111101000B. From left to right, as shown in Table 1, these 16 binary digits equate to the microprocessor address lines A15 to A0.

Since some of the address lines will be high and some will be low when the desired address (37E8H) appears on the address bus, we use inverters to give each line the correct sense. This means inverting A15, A14, A11, A4, A2, A1 and A0. Note that these correspond to the zeros in Table 1. When all 16 inputs to the 7430s are high (binary 1), the output of IC3b at pin 6 (address decode) will go high. This happens when, and only when, the address 37E8H is on the address bus.

We can determine whether the processor wants to read or write by monitoring the RD and WR leads from the keyboard expansion port. These are active low signals. This means that the processor will take RD low when it wants to read and WR low when it wants to write.

By NANDing "address decode" from IC3b, pin 6, with RD we can generate a "READ strobe" at pin 11 of IC3d. NAND-



The complete TRS-80 to RS-232 interface. The card on the left is the address decoder and parallel port. On the right is the Electronic Systems UART and Baud Rate Generator board with their TTL to RS-232 converter mounted on top of it. Shown to the rear is the interconnection assembly. The connector on the left plugs into the expansion bus on the back of the TRS-80 keyboard unit, and the two interface cards plug into the connectors on the right. The transmit and ground leads to the printer connect to two pins on the top right-hand connector.

ing "address decode" with WR will give us a "WRITE strobe" at pin 8 of IC3c. These two strobes correspond to the 37E8 READ and 37E8 WRITE leads found on the TRS-80 Expansion Interface schematic.

When 37E8 READ goes active (low), the Tri-state buffer (IC4) will gate status information onto the data bus for the processor to read. This includes: "printer busy," "out of paper," "unit select" and "fault." The first two are active low and the last two are active high.

When 37E8 WRITE goes active (low), the octal latch (IC5) latches (stores) the ASCII character that the processor has put on the data bus. This is necessary because the character will only be on the data bus for a few microseconds or

so—not long enough for the printer to utilize it. The latch will hold this character until the next one is sent.

Finally, the one shot (IC6) will provide a strobe to the printer telling it that the next character is ready to be printed. IC6 lengthens the 37E8 WRITE pulse, and it isn't necessary if you are going to use a UART. Then the output of IC3c, pin 8 can go directly to the UART.

At this point, if you are going to use the Centronics 779 or an equivalent line printer, you can jump down to the section on construction. However, if you are going the RS-232 route as I did, read on.

Serial RS-232

A serial port handles data (8-bit ASCII characters) one bit

Address bus -->	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
37E8 hex -->	0	0	1	1	0	1	1	1	1	1	1	0	1	0	0	0

Table 1. The relationship between the address bus and a binary 16-bit address. Since the NAND gates (ICs 1 and 2) of Fig. 1 require a high level (binary 1), address lines that are low (binary 0) are inverted before being used.



Fig. 2a. The interconnection wiring between the TRS-80 expansion port and the parallel interface of Fig. 1. The leads on the right side go to the parallel printer of Fig. 3 or to the UART of Fig. 4a.

at a time as opposed to a parallel port, which passes all eight bits at once. Loosely defined, the RS-232 standard says that a high (or binary 1) should be +12 volts and that a low (or binary 0) should be -12 volts. Up to this point our signals have all been TTL levels in which a high is represented by +5 volts and a low by ground.

In order to implement a serial RS-232 port we must take the eight bits presented to us on the data bus in parallel and send them to the printer one bit at a time. This includes providing the proper timing for the particular printer involved. We must also change the TTL levels of +5 volts (binary 1) and 0 volts (binary 0) to the RS-232 levels of +12 volts and -12 volts.

The first two parts of this task are easily taken care of by an IC called a universal asynchronous receiver/transmitter, or UART. There are many different versions of the UART available from the IC manufacturers; the one I used was the AY-5-1013A. The UART is a full-duplex device and, as its name implies, it will receive as well as transmit. In this application we will only be using the transmitter.

Construction

You can build the circuit of Fig. 1 in any way that is convenient. Perfboard or Vectorbord can be used, but I prefer to build

all of my circuits on standard 44-contact prototype boards. The Hobby Board from OK Machine and Tool is the one I use.

The +5 volts required by Fig. 1 are available from the keyboard expansion port, but I don't know how much current this will supply. If the fuse blows or the power supply gets too hot, then you will have to provide a separate source of +5 volts. Using the "LS" versions of the 7400 series ICs involved will cut down on the current requirements.

Fig. 2a shows the interconnections between the TRS-80 keyboard expansion port and the parallel interface (Fig. 1). Fig. 2b is an explanatory drawing of the manner in which the contacts on the expansion port are counted. Fig. 3 contains the connections between the parallel interface and the Centronics 779 or similar line printer.

Two connectors will be required. The one that plugs into the keyboard expansion port is identified in my TRS-80 manual as AMP part number 88103-1. Unfortunately, my local Radio Shack store does not stock them. Two different versions are available from Applied Invention, RD2, RT21, Hillsdale NY 12529. One is the solder-tail type; the other comes with 18 inches of ribbon cable attached.

You will also need a connector to match the one on your

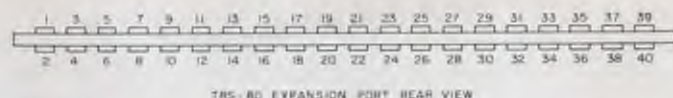


Fig. 2b. Rear view of the TRS-80 expansion port from the keyboard unit.

printer. This will depend on the type of printer.

For those of you who want to use a printer with an RS-232 interface, such as the Teletype Models 33 or 43, the circuitry becomes a little more complicated, but it is still well worth the trouble if it saves you the cost of a new printer.

Rather than build my own UART board I chose to use the UART and Baud Rate Generator board available from Electronic Systems, PO Box 21638, San Jose CA 95151, (408) 226-4064. Write or call for a copy of their catalog, which contains many useful computer-related circuit kits and etched boards.

You will find this UART board described in my article "Parallel Port to RS-232," *Kilobaud Microcomputing*, April 1979, p. 62. You can save quite a bit of money by purchasing the bare board if you already have a UART on hand.

I chose to combine the UART board, which is constructed on a 44-contact card, with a TTL to RS-232 converter kit also available from Electronic Systems. This mating and the modifications required are described in the above article. I advise anyone who is going to tackle this project to read it. The parallel-to-serial and TTL-to-RS-232 conver-



NOTE: STRAP THE FOLLOWING CONTACTS ON THE PRINTER PLUG TO EACH OTHER AND TO GND: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 27, 29, 33, 34.

Fig. 3. Connections to the Centronics 779 or similar line printer. The pin numbers shown are for the plug that mates to the connector on the back of the printer.

sion circuits can be built from scratch, but it is much easier and quicker when you have access to a PC board with the circuit already etched on it.

Fig. 4a shows the interconnections between the parallel interface, the UART board and the printer serial port. In this case, Fig. 4b should be added to Fig. 2a to make the interface believe that it is connected to the 779 printer. Put this on the same board that Fig. 1 is built on.

Note that in addition to +5 volts, we are also calling for +12 volt and -12 volt supplies. This is to power the UART and to provide the RS-232 levels. Do not

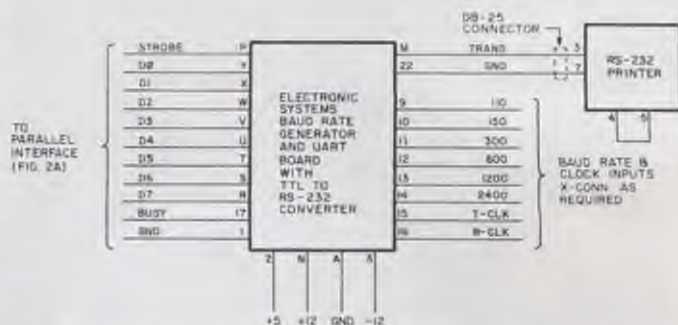


Fig. 4a. Connections in and out of the combined UART, baud rate generator and TTL-to-RS-232 converter. See the reference in the text for more information on this combination. The desired baud rate should be connected to the transmit clock (T-CLK). The strap shown between 4 and 5 on the RS-232 printer plug is to satisfy an internal requirement.

take the +5 from the keyboard to power Fig. 4a. Current requirements are low, and a simple supply will suffice. It must, of course, be regulated.

As mentioned, I built Fig. 1 on a 44-contact Hobby Board; the UART circuitry is constructed on a similar board. Then I mounted two 44-contact edge connectors above each other on a chassis with corner brackets as shown in Fig. 5. These connectors are readily available and come in solder-tail and wire-wrap types. I prefer the wire-wrap type since I am continually changing things.

The cables to the TRS-80 and the printer exit to the rear. Since there is no need to get at the cards once everything is working OK, a cover could be built to improve the appearance of the unit. If a large enough chassis were used, the power supply could be built inside of it.

I'm using a minicomputer power supply that I picked up at an electronics surplus store. They also had some surplus card cages for the 44-contact connectors that would have made an ideal mounting assembly. I'm sorry that I didn't pick them up, but I'll be watching for some for my next project.

After everything is wired together the options must be determined. Note in Fig. 4a the contacts identified as baud rate and clocks. The baud rate required for your printer must be connected to the Transmit Clock. My Model 43 operates at 300 baud; therefore, contact 11 (300 baud) is connected to contact 15 (Transmit Clock). See Fig. 4c for a bottom view of the 44-contact edge connector that the Baud Rate Generator and UART board is plugged into. The

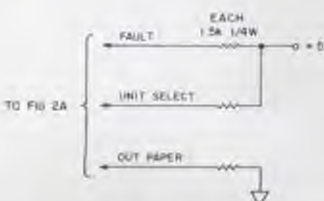


Fig. 4b. This little mod is used with Fig. 1 when it is connected to a UART. This will properly condition fault lines that normally go to the line printer.

baud rate clocks should be adjusted to the correct frequency as explained in the above referenced article.

There is also a multiple DIP (double in-line package) switch on the UART board that must be set. Table 2 gives the options available. My requirements were: S1—ON (input strobe negative), S2—not used, S3—OFF (even parity), S4—ON and S5—OFF (seven bits per character), S6—OFF (two stop bits) and S7—ON (parity). The only settings that you might have to change relate to parity. If in doubt, leave S7 off and ignore S3.

Implementation

With the parallel interface installed between the keyboard and a Centronics 779 or equivalent, all that is required for hard copy is to substitute LPRINT and LIST statements for PRINT and LIST as necessary. Unfortunately, at the last minute a snag that apparently was going to scuttle my intention to use the Model 43 appeared.

For some reason the writers of Level II BASIC apparently decided not to output a line feed after each carriage return. A line feed is not required with printers, such as the Selectric, that automatically provide one each time a carriage return is received. I don't have access to a Centronics 779, but I have to



Fig. 4c. A bottom view of the UART and baud rate generator connector showing how the contacts are identified. You can assign your own contacts on the interface board.

Switch	Purpose	Condition
S1	Input strobe polarity	ON = NEG OFF = POS
S2	Output strobe polarity	ON = POS OFF = NEG
S3	Parity	ON = ODD OFF = EVEN
S4&S5	Bits per Character	S4 S5 BITS
		ON ON 5
		OFF ON 6
		ON OFF 7
		OFF OFF 8
S6	Stop bits	ON = 1 OFF = 2
S7	Parity	ON = YES OFF = NO

Table 2. Options available on the Electronic Systems Baud Rate Generator and UART board. These are actually features of the AY-5-1013A and similar UARTs.

assume that it incorporates that feature. However, neither the Model 33 nor 43 does, and it is awfully hard to read a program listing that is all printed on one line.

I thought I was done for until a little study revealed that the address of the print driver routine is stored in RAM and not in ROM. All that should be required is to poke an address into this storage location pointing to a new print driver residing in high memory. This may sound like extra work since the print driver routine would have to be loaded every time the TRS-80 was turned on, but it still beats buying another printer.

There are many different ways of loading the new print driver routine. If you are running T-BUG, you can create a "SYSTEM" program on tape and load it each time you use the TRS-80.

There are also other assembly-language monitors available, such as the ESP-1 from Small System Software.

I've written an assembly-language monitor in Level II BASIC that is described in "Monitor," *Kilobaud Microcomputing*, June, 1979, p. 26. You can also write a straight BASIC program to poke the necessary information into memory.

Program A is the listing of the new print driver routine that I have been referring to. It will pass each character to the printer port whenever it is called, and it will add a line feed (0AH) each time that it detects a carriage return (0DH).

The print driver starting address is stored at locations 4026H and 4027H. These locations normally contain 058DH, the address of the Level II print driver in ROM. 4026H and 4027H must be changed to point to the address of the new print driver, 7FE0H.

Program B does the same thing that Program A does, except that an assembly-language monitor is not needed. Each time Program B is run it will change 4026H and 4027H and load the print driver into memory starting at 7FE0H.

Now let's look at the software steps necessary to make everything operational. When you turn the TRS-80 on it asks you, "MEMORY SIZE?" You type 32734 to reserve some high memory for the new print driver.

If you are not going to use an assembly-language monitor, you can skip this paragraph. Load your monitor, enter Program A at 7FE0H, E0H at 4026H,

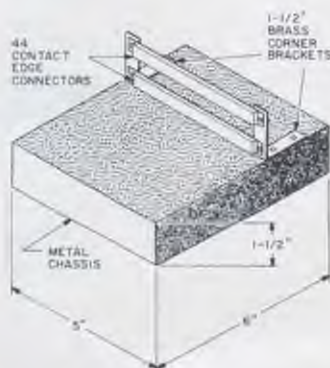


Fig. 5. One way of mounting the two circuit boards described in this article. Many other arrangements could be worked out. However you do it, keep the leads from the TRS-80 to the interface and from the interface to the printer as short as possible.

ADDRESS	MACHINE	LABEL	MNEMONICS	COMMENTS
	CODE			
7FE0	3A E0 37	LOOP	LDA PORT	READ STATUS
7FE3	E4 F0		ANI F0H	MASK LOWER HALF
7FE5	FE 30		CPI 30H	IS PRINTER READY?
7FE7	C2 E0 7F		JNZ LOOP	IF NOT, TRY AGAIN
7FEA	79		MOV A,C	GET CHARACTER
7FEB	FE 00		CPI CR	IS IT CARRIAGE RETURN?
7FED	C2 F0 7F		JNZ OUT	IF NOT, GOTO OUT
7FF0	32 E0 37		STA PORT	WRITE CHARACTER
7FF3	0E 0A		MVIC LF	LOAD LINEFEED
7FF5	C3 E0 7F		JMP LOOP	CHECK STATUS
7FF8	32 E0 37	OUT	STA PORT	WRITE CHARACTER
7FFB	C9		RET	RETURN TO BASIC

Program A. The print driver routine that is required if your printer does not insert a line feed after each carriage return it receives. This was written on an 8080 assembler, but the TRS-80 doesn't know any better and will run it anyhow. Although this is for the Level II 16K TRS-80, it will work in the 4K machine by changing all of the 7Fs to 4Fs. Your response to MEMORY SIZE? would then be 20447.

7FH at 4027H, and make a tape for later use.

Program B can be loaded from the keyboard like any other BASIC program, and a "CSAVE" will give you a tape copy.

From now on, all you have to do is load the print driver from tape. If it is the Program B version, you will also have to run it; then it can be deleted with a NEW.

This is another of those cases where it sounds more compli-

cated than it is. Try it and see.

Conclusion

Once I discovered that I was going to have to write my own print driver routine I was tempted to abandon the memory-mapped I/O port and go to straight I/O addressing. This would have reduced the number of ICs in the interface by two or three since I'd only have to decode eight bits instead of 16, and I'd pick an I/O port, such as

```

10 REM *PRINT DRIVER ROUTINE*
20 REM *BY ROB HALLER TOMBSTONE, AZ*
30 REM *16 JANUARY 1979*
40 POKE 16422,224
50 POKE 16423,127
60 FOR I=1 TO 28
70 READ B
80 POKE 32735+I,B
90 NEXT I
100 DATA 58,232,55,230,240,254,40
110 DATA 194,224,127,121,254,13,194
120 DATA 248,127,50,232,55,14,10
130 DATA 195,224,127,50,232,55,201
140 END

```

Program B. This is Program A rewritten in Level II BASIC. Running it will POKE the start address of the new print driver routine at 4026H and 4027H. Note that the address is stored least significant byte first, i.e., E0H in 4026H. It will then POKE the new print driver starting at 7FE0H. Write this one for 4K by changing 127 to 79 each time it appears in the data statements.

FDH, that would require minimum address line inversion. Since the interface was already built by then, I decided to leave it alone.

I could also have reduced the number of inverters required by using NOR gates instead of NAND gates for IC3. Also, I could have reduced the +5 requirements by using the 74LS series of ICs. However, to expedite the project, I used the chips I had on hand.

A while ago I interfaced an

RS-232-EBCD-coded Selectric to my Sol using this same circuit. I no longer have the Selectric, but I'll bet it wouldn't take much to get it working with the TRS-80.

There is no good substitute for hard copy. I hope the information that I have provided above and in the referenced articles will help you interface a printer to your TRS-80. I'll be glad to answer any questions that are accompanied by a self-addressed stamped envelope. ■

Key Electronics

Full ASCII Professional Keyboard Kit, Model 756

Model 756 Keyboard Kit	\$64.95
Model 701 Plastic Enclosure	14.95
Model 702 Steel Enclosure	29.95
Model 710 Numeric Keypad	9.95
2376 Keyboard Encoder IC	9.95
15 pin Dual edge connector*	1.95
*(FREE with ALL keyboard orders)	

INTEGRATED CIRCUITS:

SN76477N Complex Sound Generator	\$2.95
TL489C Analog Level Detector	1.25
LM317T Adj. Volt. Reg. 1.5 amp.	2.75
ICM7555 Low Pwr. CMOS Timer	1.25
LF351N High Speed JFET Op Amp	.75
NE565 Phase Locked Loop	1.10

FREE: CA3140 with orders of \$5.00 or more
Please include \$1.00 for postage and handling

N.Y.S. Residents Add 4% Sales Tax
Send to: **Key Electronics**
P.O. Box 3506
Schenectady, NY 12303 ✓ K14

C-10

SHORT CASSETTES

50 FT.

Qty.	Price
1	\$1.00
10	\$0.75
50	\$0.65

Premium tape and cassettes acclaimed by thousands of repeat order microcomputer users. Price includes labels, cassette box and shipping in U.S.A. VISA and M/C orders accepted. California residents add sales tax. Phone (408) 735-8832.

MICROSETTE CO.
777 Palomar Avenue
Sunnyvale, CA 94086

SURPLUS ELECTRONICS

ASCII

ASCII

IBM SELECTRIC BASED I/O TERMINAL WITH ASCII CONVERSION INSTALLED \$645.00

- Tape Drives • Cable
- Cassette Drives • Wire
- Power Supplies 12V15A, 12V25A, 5V35A Others, • Displays
- Cabinets • XFMRs • Heat Sinks • Printers • Components

Many other items. SEND \$1.00 FOR CATALOG. REFUNDABLE/FIRST ORDER

WORLDWIDE ELECT. INC. ✓ W16
130 Northeastern Blvd.
Nashua, NH 03060

Phone orders accepted using VISA or Master Charge
call 603-889-7661

PET & CBM SOFTWARE BREAKTHROUGH

MAIL LIST

Disk-based, updates & sorts by all fields. Specify 16K or 32K.

\$50.00

BOWLING LEAGUE SECRETARY

Disk-based, generates recap & individual average record sheet at command. For 32K.

\$100.00

CBM WORD PROCESSOR

Disk and ROM-based full screen editing & scrolling. Written in 6502 machine language. For 16K or 32K.

\$100.00

We also have a disk-based GENERAL LEDGER, ACCOUNTS PAYABLE, ACCOUNTS RECEIVABLE, PAYROLL & INVENTORY for 32K PET or CBM.

Each module..... \$120.00
Complete 7 Modules..... \$600.00

Complete system with 32K computer, 2040 dual disk drive, 2022 tractor feed printer & GL A/P, A/R, Payroll & INV. for..... \$4250.00

Write for our free catalog or ask your dealer to contact:

COMPUTER CONCEPTS
BUSINESS SYSTEM CONSULTANT
617 W. 16th St.
Cheyenne, WY 82001
(307) 632-9132

C167



Featuring RCA 1802 COSMAC CPU
Own a powerful home computer system, starting for just \$99.95—a price that gets you up and running the very first night... with your own TV for a video display. \$99.95 ELF II includes RCA 1802 8-bit microprocessor addressable to 64k bytes with DMA, interrupt, 16 registers, ALU, 256 byte RAM, full hex keyboard, two digit hex output display, stable crystal clock for timing purposes, RCA 1801 video IC to display your programs on any video monitor or TV screen and 5-pin video expansion bus (flex connectors) to expand ELF II into a giant!

ELF II Explodes Into A Giant!
Master ELF II's 199.95 capabilities, then expand with GIANT BOARD KLUDGE BOARD, 4k RAM BOARDS, TINY BASIC, ASCII KEYBOARD, LIGHT PEN, ELF-BUG MONITOR, COLOR GRAPHICS & MUSIC SYSTEM, TEXT EDITOR, ASSEMBLER, DISASSEMBLER, VIDEO DISPLAY BOARD and, another great reason for getting your ELF II now—

BREAKTHROUGH!

Netronics proudly announced the release of the first 1802 FULL BASIC, written by L. Sandlin, with a hardware floating point RPN math package (requires 8k RAM plus ASCII and video display boards), \$79.95 plus \$2 p&h. Also available for RCA VIP and other 1802 systems (send for details!)

Master This Computer In A Flash!

Regardless of how minimal your computer background is now, you can learn to program an ELF II in almost no time at all. Our Short Course On Microprocessor & Computer Programming—written in non technical language—guides you through each of the RCA COSMAC 1802's capabilities, so you'll understand everything ELF II can do... and how to get ELF II to do it! Don't worry if you've been stumped by computer books before. The Short Course represents a major advance in literary clarity in the computer field. You don't have to be a computer engineer in order to understand it. Keenly ELF II, it's loaded with "hands on" illustrations. When you're finished with the Short Course, neither ELF II nor the RCA 1802 will hold any mysteries for you.

In fact, not only will you now be able to use a personal computer creatively, you'll also be able to read magazines such as BYTE, INTERFACE AGE, POPULAR ELECTRONICS and PERSONAL COMPUTING and fully understand the articles. And, you'll understand how to expand ELF II to give you the exact capabilities you need!

If you work with large computers, ELF II and the Short Course will help you understand what they're doing.

Get Started For Just \$99.95, Complete!

\$99.95 ELF II includes all the hardware and software you need to start writing and running programs at home, displaying video graphics on your TV screen and designing circuits using a microprocessor—the very first night—even if you've never used a computer before.

ELF II connects directly to the video input of your TV set, without any additional hardware. Dr. with an \$8.95 RF modulator (see coupon below), you can connect ELF II to your TV's antenna terminals instead.

ELF II has been designed to play all the video games you want, including a fascinating new large-invisible gun game that was developed specifically for ELF II. But games are only the icing on the cake. The real value of ELF II is that it gives you a chance to write machine language programs—and machine language is the fundamental language of all computers. Of course, machine language is only a starting point. You can also program ELF II with assembly language and say BASIC. But ELF II's machine language capability gives you a chance to develop a working knowledge of computers that you can't get from running only

Write and run programs—the very first night—even if you've never used a computer before!

You're up and running with video graphics for just \$99.95—then use low cost add-ons to create your own personal system that rivals home computers sold for 5-times ELF II's low price!

pre-recorded tape cassettes.

ELF II Gives You The Power To Make Things Happen!

Expanded, ELF II can give you more power to make things happen in the real world than heavily advertised home computers that sell for a lot more money. Thanks to an ongoing commitment to develop the RCA 1802 for home computer use, the ELF II products—first introduced by Netronics—keep you right on the outer fringe of today's small computer technology. It's a perfect computer for engineering, business, industrial, scientific and personal applications.

Plug in the GIANT BOARD to record and play back programs, edit and debug programs, communicate with remote devices and make things happen in the outside world. Add Kluge (prototyping) Board and you can use ELF II to solve special problems such as operating a complex alarm system or controlling a printing press. Add 4k RAM Boards to write longer programs, store more information and solve more sophisticated problems.

ELF II also includes the ELF II Light Pen and the amazing ELF-BUG Monitor—two extremely recent breakthroughs that have not yet been duplicated by any other manufacturer.

The ELF-BUG Monitor lets you debug programs with lightning speed because the key to debugging is to know what's inside the registers of the microprocessor. And, with the ELF-BUG Monitor, instead of single stepping through your programs, you can now display the entire contents of the registers on your TV screen. You find out immediately what's going on and can make any necessary changes.

The incredible ELF II Light Pen lets you write or draw anything you want on a TV screen with just a wave of the "magic wand." Netronics has also introduced the ELF II Color Graphics & Music System—more breakthroughs that ELF II owners were the first to enjoy!

ELF II Tiny BASIC

Ultimately, ELF II understands only machine language—the fundamental coding required by all computers. But, to simplify your relationship with ELF II, we've introduced an ELF II Tiny BASIC that makes communicating with ELF II a breeze.

Now Available! Text Editor, Assembler, Disassembler And A New Video Display Board!

The Text Editor gives you word processing ability and the ability to edit programs or text while it is displayed on your video monitor. Lines and characters may be quickly inserted, deleted or changed. Add a printer and ELF II can type letters for you—error free—plus print names and addresses from your mailing list!

ELF II's Assembler translates assembly language programs into hexadecimal machine code for ELF II use. The Assembler features mnemonic abbreviations rather than numerics so that the instructions on your programs are easier to read—this is a big help in catching errors.

ELF II's Disassembler takes machine code programs and produces assembly language source listings. This helps you understand the programs you are working with... and improve them when required.

The new ELF II Video Display Board lets you generate a sharp, professional 32 or 64 character by 16 line upper and lower case display on your TV screen or video monitor—dramatically improving your unexpanded \$99.95 ELF II. When you get into longer programs, the Video Display Board is a real blessing!

Now Available!

☐ A-D/D-A Board Kit includes 1 channel (expandable to 4) D-A, A-D converters, \$39.95 plus \$2 postage & handling.

☐ PILOT Language—A new text-oriented language that allows you to write educational programs on ELF II with speed and ease! Write programs for games... unscrambling sentences... spelling drills... "fill in the missing word" tests, etc! PILOT is a must for any ELF II owner with children. PILOT Language on cassette tape, only \$19.95 postpaid!

☐ Game Package on cassette tape (requires 4k RAM), \$9.95 plus \$2 postage & handling.

Clip Here and Attach to Your Order Below!

PHONE ORDERS ACCEPTED!
Call (203) 354-9375

CUDDLY SOFTWARE

Unbreakable Systems/Support Software for any 1802 system.

C505 Series (Operating System)— aids development and modification of user programs with software tools, like Add/Delete Byte, which also expand/contract the remainder of the memory page. User Programs all interface via Std. Call/Ret. for video routines, I/O drivers, etc. 1801 alphanumeric output via Screen Driver (10 lines, ave. 17 char/line, auto-scroll). User graphics also made easy.

C5TP Series (Trace Program)— 1802 CPU in software! Displays internal status as it simulates user programs for debugging, improvement, or learning 1802 operation. A must for every programmer! Intervene to alter simulation dynamically, by changing parameters, overriding program branch decisions, etc. Memory protected! C5TP cannot be bombed by the worst text program or user key-in errors. Needs 2.5K RAM, plus user program area.

COMING SOON: Assembler, Text Editor, Text Formatter, I/O for 1802 PILOT!

TAILORED to your system! Write for details and low prices.

CUDDLY SOFTWARE

Dept. K37

C123

98 THORNDALE TERRACE
ROCHESTER, NEW YORK 14611

Netronics R&D Ltd., Dept. K-1
333 Litchfield Road, New Milford, CT 06776

Yes! I want my own computer! Please rush me—

☐ RCA COSMAC ELF II kit at \$99.95 plus \$3 postage and handling (requires 6.5 to 8 watt AC power)

☐ Power Supply (required) \$4.95 postpaid

☐ RCA 1801 User's Manual \$5 postpaid

☐ Tom Forman's Short Course On Microprocessor & Computer Programming (see how you get about everything there is to know about ELF II or any RCA 1802 computer. Written in non technical language. It is a learning breakthrough for engineers and laymen alike. \$5 postpaid.

☐ Deluxe Metal Cabinet with prewired front cover for ELF II \$29.95 plus \$2.50 p&h

☐ I am enclosing payment (including postage & handling) for the items checked below:

☐ I want my ELF II wired and tested with power supply, RCA 1801 User's Manual and Short Course—all for just \$149.95! \$3 p&h.

ALSO AVAILABLE FOR ELF II—

☐ GIANT BOARD™ kit with cassette I/O, RS-232, C1717 I/O, 8 to 16 I/O, decoders for 14 separate I/O addresses and a system memory reader. \$39.95 plus \$2 p&h.

☐ Kluge (Prototyping) Board accepts up to 16 IC's. \$17.00 plus \$1 p&h.

☐ 4k Static RAM kit. Addressable to any 4k page (a kit). \$9.95 plus \$3 p&h.

☐ 50-pin 66-pin connectors (solder required for each plug-in board). \$5.70 kit. postpaid.

☐ Expansion Power Supply (required when adding 4k RAM). \$34.95 plus \$3 p&h.

☐ Professional ASCII Keyboard kit with 128 ASCII upper/lower case and 96 printable characters, onboard regulated power logic (selection and choice of 4 pin-shaving signals) to mate with almost any computer. \$64.95 plus \$2 p&h.

☐ Deluxe metal cabinet for ASCII Keyboard. \$19.95 plus \$2.50 p&h.

☐ Video Display Board kit lets you generate a sharp professional 32 or 64 character by 16-line upper and lower case display on your TV screen or video monitor—dramatically improving your unexpanded \$99.95 ELF II. (It's made ASCII Keyboard cabinet.) \$89.95 plus \$2 p&h.

☐ ELF II Tiny BASIC on cassette tape. Comments include SAVE, LOAD, etc. \$5.00 plus \$1 p&h.

language. It is a learning breakthrough for engineers and laymen alike. \$5 postpaid.

☐ 26 variables A-Z, LET, IF, THEN, INPUT, PRINT, GO TO, END, SUB, RETURN, END, REM, CLEAR, LIST, RUN, PILOT, PILOT, PILOT, PILOT. Comes fully documented, and includes alphanumeric generator required to display alphanumeric characters directly on your TV screen without additional hardware. Also plays tick-tack-toe plus a drawing game that uses ELF II's hex keyboard to a 16x16 4k memory requirement. \$14.95 postpaid.

☐ Tom Forman's Short Course on Tiny BASIC for ELF II \$5 postpaid.

☐ ELF-BUG™ Deluxe System Monitor on cassette tape. Allows displaying the contents of all registers on your TV at any point in your program. Also displays 24 bytes of memory with full addresses, including LUT and auto scrolling. A must for the serious programmer! \$14.95 postpaid.

☐ Text Editor on cassette tape gives you the ability to insert, delete or edit lines and words from your programs while they are displayed on your video monitor. (Add printer and you can use ELF II to type letters, plus insert names and addresses from your mailing list.) \$19.95 postpaid.

☐ Assembler on cassette tape translates assembly language programs into hexadecimal machine code for ELF II use. Mnemonic abbreviations for instructions (rather than numerics) make programs easier to read and help prevent errors. \$19.95 postpaid.

☐ Disassembler on cassette tape takes machine code

programs and produces assembly language source listings to help you understand and improve your programs. \$19.95 on cassette tape.

☐ SAVE \$9.95—Text Editor, Assembler, & Disassembler purchased together, only \$49.95! (Requires Video Display Board plus 4k memory.)

☐ ELF II Light Pen, assembler & lesson. \$7.95 plus \$1 p&h.

☐ ELF II Color Graphics & Music System Board kit. \$49.95 plus \$3 p&h.

☐ ELF II connects directly to the video input of your TV set without additional hardware. To connect ELF II to your antenna terminals instead, order RF Modulator. \$4.95 postpaid.

COMING SOON: A-D, D-A Converter, Cereometer Board and more.

Name _____

Address _____

City _____

State _____ Zip _____

CALL TOLL FREE: 800 243-7428

DEALER INQUIRIES INVITED

The OSI Challenger 1P MF

Just starting microcomputing? You might try this minifloppy system from Ohio Scientific.

Charles Curley
6061 Lime Ave.
Long Beach CA 90805

The OSI Challenger 1P MF (minifloppy) is an excellent starter system for the beginner home computerist who wishes to get into computing with a maximum of ease but a minimum of expense. If the beginner wishes to expand, he can do so with no problems, but the unit is almost stand-alone as it comes. With one exception, the documentation is excellent, and OSI promises to provide user support for years to come.

Ohio Scientific has been advertising their new C1P MF as the first minifloppy system available for under \$1K. Strictly speaking, it is. However, a user will need one or two more items in order to use the system: a TV or monitor and perhaps a TV signal generator.

Due to FCC regulations, a computer manufacturer cannot sell a computer that you can just hook up to your TV, so you have three options: (1) buy a monitor and take the intermediate frequency signal the computer produces and feed it to the monitor; (2) modify your present TV for direct video signal injection (i.e., allow it to also function as a monitor); or (3) buy a TV signal generator to feed the computer's signal into your TV.

In any case, the additional expense will run \$20 to \$130, depending on which way you go and how much quality you insist on. Still, \$1100 is impressive for a minifloppy system.

This is definitely a bare-bones system. Peripherals such as an extensive monitor or color graphics are available as extras only. Considering that the proper customer for the Challenger 1P MF is the newcomer to personal computing, this is not a serious objection. Indeed, you can say that it gives the

customer something to look forward to.

This machine is clearly aimed at the beginner who wishes to enter personal computing as painlessly as possible. One could spend much less and buy, say, a KIM. Then you could program in assembly language and hand assemble. Or you could spend an amount comparable to the cost of the C1P MF and buy, say, a PET or a TRS-80. In either case, you would still have to use a cassette for bulk storage, with all the hassles that cassettes imply. A minifloppy drive for the PET or TRS-80 would cost \$400 or so, an amount the C1P MF owner could put to other uses.

Software

In the bare-bones configuration of the C1P MF, the speed and convenience of the minifloppy disk is the main selling point of the system. The user is provided with a small DOS (disk operating system), the Pico DOS. With no memory expansion beyond the initial 12K RAM, the DOS supports two commands: LOAD X and SAVE X, where X is a digit from one to eight. X defines the storage area on the disk from which data is to be loaded or to which it is to be saved.

The addition of 8K more RAM (OSI list, \$138) will allow the use of a much more extensive DOS. Ohio Scientific's OS-65D (\$50). This DOS supports a much more extensive set of commands. It allows a file structure for programs. This means that a pro-

gram can input from or write to a file on disk (e.g., a word processor that would rapidly fill up the available RAM can put its output directly onto disk, where it has a lot more room). The enlarged DOS supports six character names for files, rename capabilities and other features.

The BASIC provided in the bare-bones machine is a Microsoft BASIC occupying 8K of ROM. It is 6½ digits in precision, has string functions, trig functions and full scientific notation, among other features. A number of these features are not found on other beginner's BASICs.

The OS-65D DOS supports a 9½ digit BASIC, which is slower than the ROM BASIC but more precise. This precision is suitable for scientific or business applications. This BASIC occupies 12K of RAM, and the user can software-select which BASIC he wishes to use.

As I mentioned, OSI does not have color graphics for the Challenger series. They expect to provide it as an option in the future. The screen resolution is 256 by 256, which divides into 32 lines of 32 characters each. However, the mechanics of televisions may restrict you to 24 lines by 24 characters.

OSI software is geared to this limitation. The characters themselves are eight dots by eight and include all standard ASCII characters. In addition, there are 160 special characters in ROM: gaming elements, graphic elements and others. Any character can be invoked simply by



The C1P MF disk-based computer.

SUBSCRIPTION APPLICATION FORM

SUBSCRIPTION FEE per year: \$15 US (half price);
\$17 Canadian currency; \$23 foreign (one year only)—must be
US funds drawn on a US bank.

Make checks to:

Kilobaud MICROCOMPUTING™

POB 997, Farmingdale NY 11737

☐ Check ☐ Am Express ☐ Mastercharge ☐ Visa

Account # _____ Expires _____

Name _____

Street _____

City _____

State _____

Zip _____

Country _____

Signature _____

501H44



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud

MICROCOMPUTING T.M.

**Subscription Department • Box 997
Farmingdale NY 11737**



POKEing the appropriate memory location with its number. A full catalog of the symbols available with their numbers in decimal (for use with BASIC) and hex (for use with machine code) is included with the manual.

The keyboard is totally software controlled. This gives the ambitious programmer much greater flexibility than with a hardware-controlled keyboard. For one thing, it allows the detection of up to eight simultaneous key depressions. One application of this facility might be to program eight keys into two pseudo-joystick arrangements. The auto-repeat feature of the keyboard software is also useful.

This flexibility also allows multiple applications of the keys, which are not immediately apparent. For example, in BASIC mode, a /SHIFT/ o deletes the last character, and a /SHIFT/ p deletes the current line. These two functions greatly facilitate program and text editing.

One function bodes well for the use of the C1P MF as a terminal. The /SHIFT/ o function appears on the display by inserting a / (ASCII 2F), rather than removing the offending character. With the cost of modems coming down, private phone systems and micro-oriented data networks in the

offing, many home computers will be used as terminals as well as stand-alone systems. OSI designed the C1P MF to be used as a terminal as well as a stand-alone, so adding this function will be easy.

Documentation

Contrary to OSI's reputation for bad or nonexistent documentation, I found the C1P MF documentation to be quite good. I quickly found whatever information I needed to use the machine. The beginning BASIC programmer will need a good book on the system, but this is true of any starter system. Anyone who wishes to program in assembly language or machine language is similarly encouraged to have a good book on 6502 programming handy. The manual does have a number of BASIC demonstrator programs that the user can enter and modify for the learning experience he will gain.

A source listing of the BASIC was noticeably missing from the documentation. This is a result of having Microsoft write the BASIC; a standard part of their contract is that no source listing can be released by the manufacturer. Fortunately for the typical user of the C1P MF, this is not a serious objection.

Options

A fully expanded system



The C1P, the cassette version of the C1P MF.

could include: 32K RAM, dual minifloppies, a cassette recorder, a printer, a modem and a number of other peripheral boards. The user can buy ready-made peripherals or build his own.

The user who has little or no interest in programming for himself can purchase ready-to-run software from OSI. Several game disks, personal or business disks and education disks are already available from OSI, with each disk containing up to eight programs. As far as I know, there are no other sources for software, but this should change as more units are sold.

The user who wants to buy a cassette machine now and expand up to a disk system later should consider the C1P, the cassette version of the C1P MF.

With only 4K of RAM and sans cassette recorder, the unit is otherwise identical to the C1P MF and lists for \$349. A minifloppy (\$450), 8K of RAM (\$138) and some diskettes (\$8 each) complete the conversion.

About the only problem I had reviewing the Challenger was finding one! I called various dealers in my area (southern California) as well as Ohio Scientific. I finally found one at Anaheim Computer and Video, who were most cooperative. If you are in southern California and wish to see a machine, give them a call (714/995-0224). Otherwise, call or write Ohio Scientific (1333 S. Chillicothe Rd., Aurora OH 44202; 216/562-3101) or OSI West (15461 Chemical Lane, Huntington Beach CA 92649; 714/891-2457). ■

TRS-80 NEEDS FILLED

TM TRS-80 is a trademark of Radio Shack, a division of Tandy Corp.

- *Disk drives—plug and run Shugart 35 or MPI 40 track @ \$319 & Micropolis 77 track @ \$570 4-drive cable @ \$34 P.P.-5" (bx of 10) disks @ \$27.50 P.P.—in hrd. case \$31 P.P.
- *Printers—Harris Selectric typewriter (refurbished) & cables @ TRS232 @ \$790—new Centronics—779 tractor @ \$950 & CENT. 730 @ \$820—cable for \$34 P.P.
- *Professional business software—mail list & Library 100 @ \$75—letter secretary or job cost @ \$240 ea.—Interact inventory control with B.O.M. @ \$299 Osborne Interact A/R, A/P, & G/L @ \$350—P/R @ \$125—All P.P.
- *Power drops & outages? System boot out? Lose data? —Get Mayday UPS (uninterruptible power supply) from \$195—write
- *MA. residents, add 5% tax** P.P. means postpaid cont. U.S.A.. All else F.O.B. Tewksbury** M/C, VISA, or check.

OMNITEK SYSTEMS

24 Marcia Jean Dr., Dept. M
Tewksbury MA 01876
Tel. 617-851-3150

018



TRS-80™

SOFTWARE

Send For Free Software Info Packet.
* D-Disk System Only * TD-Tape or Disk Level II *

Math/Stat Pac.™ \$39.95

1 Program: Linear, multiple, polynomial, geometrical, exponential regression analysis. Simultaneous statistics. Diagram with auto data. Plot any polynomial over any range (Autoscale or Calcs) with auto data.

DISK D..... \$14.95

The new file management of your Disk System. Interactive with lots of dynamic examples. Helps a beginner use the disk system.

Hangman/ Hangfile™ \$19.95

2 Programs: Educational. Create your own dynamic word files. User option multiple clues & subjects with graphics. Really fun.

Secret Words - Game™ \$17.95

3 Programs: Educational & Fun & Mind Boggling. Guess a 7,3,4,5 letter word. Review & status options. 3 variations. Canest given lots of clues. Hardest no clues.

All programs supplied on TAP or DATA DISKETTE. Indicate your preference and RAM size.



Bluebird's Inc.

1441 Greenview Ave.
East Lansing, MI. 48823

Michigan residents add 4% sales tax.



Bluebird's Inc.

1441 Greenview Ave.
East Lansing, MI. 48823

Michigan residents add 4% sales tax.



TRS-80™

SOFTWARE

Send For Free Software Info Packet.
* D-Disk System Only * TD-Tape or Disk Level II *

Compress-IT™ \$24.95

2 Programs: Remove spaces & non statements. Compress program info into multiple statement lines. Reduce RAM needs up to 50%.

Simplify-IT™ \$24.95

3 Programs: Lists in single statement lines. Searches & finds requested text or key commands. Lists all variables used in program.

TEXT™ \$49.95

A Combination Text Processor & ELECTRIC FILING CABINET. WRITE/EDIT/FILE Headers, Information Files, note directory. Disk store with auto backup options. File selection by Title or Content on 1 to 4 Disk Drives. Formats & Prints. A SELF INDEXING QUERY SYSTEM and word processor.

List'n File: Names & Things™ \$34.95

Creates and maintains NAME (customer) files. Sort using any information category. Prints lists or labels.

All programs supplied on TAP or DATA DISKETTE. Indicate your preference and RAM size.



Bluebird's Inc.

1441 Greenview Ave.
East Lansing, MI. 48823

Michigan residents add 4% sales tax.



Bluebird's Inc.

1441 Greenview Ave.
East Lansing, MI. 48823

Michigan residents add 4% sales tax.

25 START-AT-HOME COMPUTER BUSINESSES

In "Low Capital, Startup Computer Businesses"

CONSULTING • PROGRAMMING • MICRO COMPUTER OPPORTUNITIES • SOFTWARE PACKAGES • FREELANCE WRITING • SEMINARS • TAPE/DISC CLEANING • FIELD SERVICE • SYSTEMS HOUSES • LEASING • SUPPLIES • PUBLISHING • HARDWARE DISTRIBUTORS • SALES AGENCIES • USED COMPUTERS • FINDER'S FEES • SCRAP COMPONENTS • AND MORE...

Plus — ideas on moonlighting, going full-time, image building, revenue building, bidding, contracts, marketing, professionalism, and more. No career tool like it. Order now — if not completely satisfied, return within 30 days for full immediate refund.

• 8 1/2 x 11 ringbound • 156 pp. • \$20.00

Phone Orders 901-761-9090



DATASEARCH ☒ D40 Incorporated

4954 William Arnold Road, Dept. A, Memphis, TN 38117

Rush my copy of "Low Capital Startup Computer Businesses" at \$20.

NAME/COMPANY _____
ADDRESS _____
CITY/STATE/ZIP _____

☐ Check Enclosed ☐ VISA ☐ Master Charge

_____ Exp. Date _____

10 MEGABYTE HARD DISK for the

apple computer by Lobo



- \$4990 complete
 - Includes S & H in Cont. U.S.A.
 - Calif. res. add 6% sales tax
- \$3390 Add on drive w/ Power Supply
 - Includes S & H in Cont. U.S.A.
 - Calif. res. add 6% sales tax
- Up to 16 drives per controller
- 3 ways to format the disk — take your choice
 - 1 - 10 megabyte drive
 - 24 - 8" floppy drives
 - 91 - mini floppy drives
- Hardware/Software compatible
- Disk Diagnostics included
- Dealer inquiries invited

* Fully hardware/software compatible. Our D.O.S. uses all of apples D.O.S. commands in the same manner as apples, so a disk program that uses apples disk commands will work on this hard disk.

* Winchester technology—IMI-7710 disk drive

* Lobo disk controller—Z-80 based.

* Disk diagnostics include:

• Reading & writing track & sensor

• Wild card search on catalogs which allows you to locate program titles by using key characters of your choice.

* Up to 16 disk drives per controller - others only allow 4

* System price \$4990, includes disk drive, controller, power supply cables & disk operating system - others cost \$5350.

* Add-on disk \$3390 includes additional power supply - others do not include the power supply, they use one power supply for all drives, requiring shut down of one drive, before power up of another.

* D.O.S. with choices, allows you to format the disk into 91 diskette sized volumes, or 24 8" floppy sized volumes or 1 big 10 megabyte volume - others allow you to format to 88 diskette sized volumes only.

* Manufactured by Lobo, a progressive disk drive company that is always looking for ways to make disk drive use easier & more versatile.



14052 EAST FIRESTONE BOULEVARD
SANTA FE SPRINGS, CALIFORNIA 90670
(213) 921-2111 • (714) 739-0711

☒ C111



UP TO 25% OFF

YOUR OWN TRS-80 SYSTEM AT TREMENDOUS SAVINGS

① TRS-80 Complete System

Includes: CPU/Keyboard, Power Supply, Video Monitor, Cassette Recorder, Manual, and Game Cassette.

② Line Printer

③ Mini Disk System

④ C-10 Cassettes

⑤ Verbatim Diskettes



DISK DRIVES IN STOCK!

ITEM	REG. PRICE	OUR PRICE
Level II—4k	\$619.00	\$575.70
Level II—16k	\$849.00	\$789.60
Expansion Interface	\$299.00	\$278.10
Mini Disk Drive	\$ 495.00	\$ 385.00
Centronics 730 Printer	\$ 995.00	\$ 850.00
Centronics 101 Printer	\$1595.00	\$1400.00
Anadex DP-8000 Printer	\$ 895.00	\$ 995.00
Memory Kit (16K) FREE INSTALLATION	\$ 149.00	\$ 98.00
Verbatim Diskettes ea.	\$ 5.95	\$ 4.95
3	\$ 17.89	\$ 12.00
10	\$ 59.00	\$ 37.00
C-10 Cassettes	\$ 4.95	\$ 4.50
25	\$ 24.75	\$ 18.75
Paper (9 1/2 x 11 fanfold, 3500 sheets)	\$ 35.00	\$ 29.95

SALE

Centronics 779 \$995.00
Same as Line Printer I (Tractor)

TRS-80 MODEL II \$3626.00
• 64K RAM
• 1/2 MEG DISK

ADDITIONAL DISK DRIVE (1ST) \$1069.50
ADDITIONAL DISK DRIVE (2ND + 3RD) \$ 558.00

FOREIGN and DOMESTIC DISTRIBUTORSHIPS AVAILABLE...

MINI DISK DRIVES NOW \$385

Over \$100 less than Radio Shack's!



There are new developments every day—write or call for the latest information.

VTD Data ☒ V19
777 Henderson Boulevard N-6
Folcroft Industrial Park
Folcroft PA 19032
(215) 461-5300



TOLL FREE
1-(800) 345-8102 *Orders only!

"THE"
TRS-80 Users Journal
THE 80-U.S. JOURNAL

ANYTHING you can do on (or to) Level I, Level II or TRSDOS is covered in detail by **THE JOURNAL**. (We have been doing it with regularity since September, 1978!) Published bi-monthly; subscriptions are \$16.00/1 year, \$31.00/2 years, \$45.00/3 years in the U.S.; \$20.00/1 year, \$39.00/2 years, \$55.00/3 years in Canada (First class mail) \$24.00/1 year, \$47.00/2 years, \$68.00/3 years all other. (Foreign sent Airmail). MC/Visa O.K.—call (206) 475-2219 or send check or money order to:

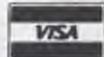
The 80-U.S. JOURNAL
PO Box 7112
Tacoma, Washington 98407

✓ E37

If your local dealer doesn't have it, send \$3.00 for a current sample issue!

TEXAS INSTRUMENT COMP	
TI 99-4 COMPUTER	\$ 995.
TI 810 BASIC PRINTER	\$1590.
TI 820 BASIC PRINTER	\$1990.
TI SOFTWARE	\$SAVE
CENTRONICS PRINTERS	
779-2 TRAC. FD	\$949.
779-1 FRIC.FD	\$890.
730-1 NEW PRNTR	\$799.
730-3	\$849.
MICRO P1 \$390. MICRO S1	\$475.
COMMODORE BUSINESS MACHINES	
PET 2001-8K	\$675.
PET 2001-16N,B	\$859.
PET 2001-32N,B	\$1090.
PET 2040 DUAL FLOPPY	\$1090.
PET 2022 TRAC.FD PRINTER	\$849.
PET 2023 FRIC.FD PRINTER	\$749.
NORTH STAR COMPUTERS	
BIG \$\$ SAVINGS	
INTERTEC SUPERBRAIN	
THE HONOR GRADUATE COMPUTER	\$2990
DISPLAY TERMINALS	
INTERTUBE II	\$775
HAZELTIME 1400	\$690.
1410	\$785
1500	\$950.
1510	\$1149.

MULTI-BUSINESS COMPUTER SYSTEMS
 28 HARBOROUGH STREET
 PORTLAND, CONN. 06480
 (203) 342-2747 ✓ M33



SAVE SAVE UP TO 25% OFF SAVE SAVE

MORE DATA PER DOLLAR—only from V R Data Corporation



V R Data Corporation, Int'l. distributor of brand name hardware, software and business systems is known worldwide for quality, dependability, prompt, personal service and discount prices.

MINI DISK DRIVES NOW \$385

Over \$100 less than Radio Shack's!

WE ARE COMMITTED TO THE TRS-80 and THE TRS-80 USERS

Fully compatible with Radio Shack's operating system TRSDOS™ and drives. Just plug in and run!

- One, two, three or four drive configurations, 102k to 408k bytes.
- All systems include a patch program to upgrade your TRSDOS™ to 40 tracks.
- Cases are finished in gray to match your system.

IMMEDIATE DELIVERY: Why wait 5 months for mini disk drives from other suppliers—get better drives—quicker—and at lower prices now!

ORDER NOW TOLL FREE 800-345-8102

VRData

✓ V19

MORE DATA PER DOLLAR

777 Henderson Boulevard N.E. • Folcroft Industrial Park • Folcroft, PA 19032 • (215) 461-5300

FOREIGN and DOMESTIC DISTRIBUTORSHIPS AVAILABLE • TOLL FREE 1-(800) 345-8102 Orders only!



A Heath H8 Disassembler

This article picks up where "CONOPS" (July 1979, page 108) left off.

Disassemble your Heath H8 software and learn from the professionals. If you want to educate yourself in the art of programming, this is one of the most productive exercises you can perform.

I have anticipated this need of H8 owners and present this disassembler, which will run on your versatile Heath machine without using up a lot of that expensive memory. You are already familiar with "CONOPS," the H8 console-oriented operating system (July 1979 *Microcomputing*, p. 108). This disassembler uses many CONOPS subroutines and has been cunningly designed to occupy a block of adjacent memory, which makes permanent attachment easy.

What Does It Do?

A disassembler looks at a program stored in memory and helpfully translates each instruction byte from binary code

CONOPS, including the disassembler and string finder, is available from the author for \$5 (one per customer). It comes on cassette in H8 memory image format, assembled to start at any requested address between 2700 and B700.

into the mnemonic language used by assemblers. Just tell "Sammy" where to begin and he will print the instruction address, the hexadecimal instruction and the corresponding mnemonic.

Sammy will not give you labels or remarks and can deal only with instruction codes. Data bytes (ASCII characters, for example) are not recognized. Sammy assumes everything is an instruction and will print garbage when data is encountered. On a straight op code diet, he will make no errors and, fortunately, will recover in a couple of bytes when meeting instruction bytes again after being brought down by data.

How to Use It

Load the program into your H8, byte by byte. It will take some time, but the listing is in hexadecimal, so you can use the efficient CONOPS program loader referenced earlier. To run the disassembler, hit G for GO and enter 67DF, the starting address. You will then see the following display:

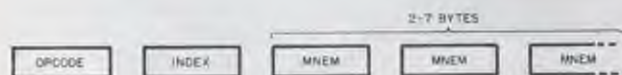


Fig. 1.

BEGIN ADDR?
Now, enter the address of the first byte of the program you wish to disassemble. Take care to start it on the first byte of an instruction code. If you enter 6C00, the start of CONOPS, you will be rewarded with a display as follows:

6C00 C3 C1 8E JMP

Push any key other than A or S to decode the next instruction:

6C03 7E MOV A,M

If you want to save yourself the trouble of pushing a key to advance the disassembler, you can press the A key, which will change the mode to automatic. The program will then do its own stepping and can be stopped only by a reset applied from the H8 front panel keypad. The automatic mode is useful if you have a printer. In the one-step mode, entering an S will stop the program and exit to ***, the operating system ready prompt.

How Does It Work?

Look at an 8080 op code table, like the one on the large plastic card that comes with your H8, and you will see that the mne-

monics have a curious variety. The character count of the main word ranges from 2 to 4. Appended characters number 0 to 4. Many bytes of any disassembler are used by the mnemonic lookup tables. For each of the 244 op codes, the program must contain the following data: the mnemonic, coded in ASCII; formatting information; and instruction byte count.

A single lookup table holding all this data would use about 1400 bytes of memory. Such a table would contain many repetitive words. For example, MOV appears in 63 instructions; the appended letter B appears in 45. Avoiding as much of this wasteful duplication as possible was one of the main considerations in the design of this disassembler program.

Studying the op code table reveals some useful facts.

1. Bits 6-7 of the op code identify certain subgroups. In split-octal, these two bits are 0, 1, 2 or 3.
2. All codes starting with 1 or 2 are single-byte instructions.
3. All codes in octal group 100-177, with one exception, are MOV instructions.
4. Codes in octal 200-277 are combinations of eight 3-character, basic mnemonic words plus eight single-character operands.



Fig. 2.

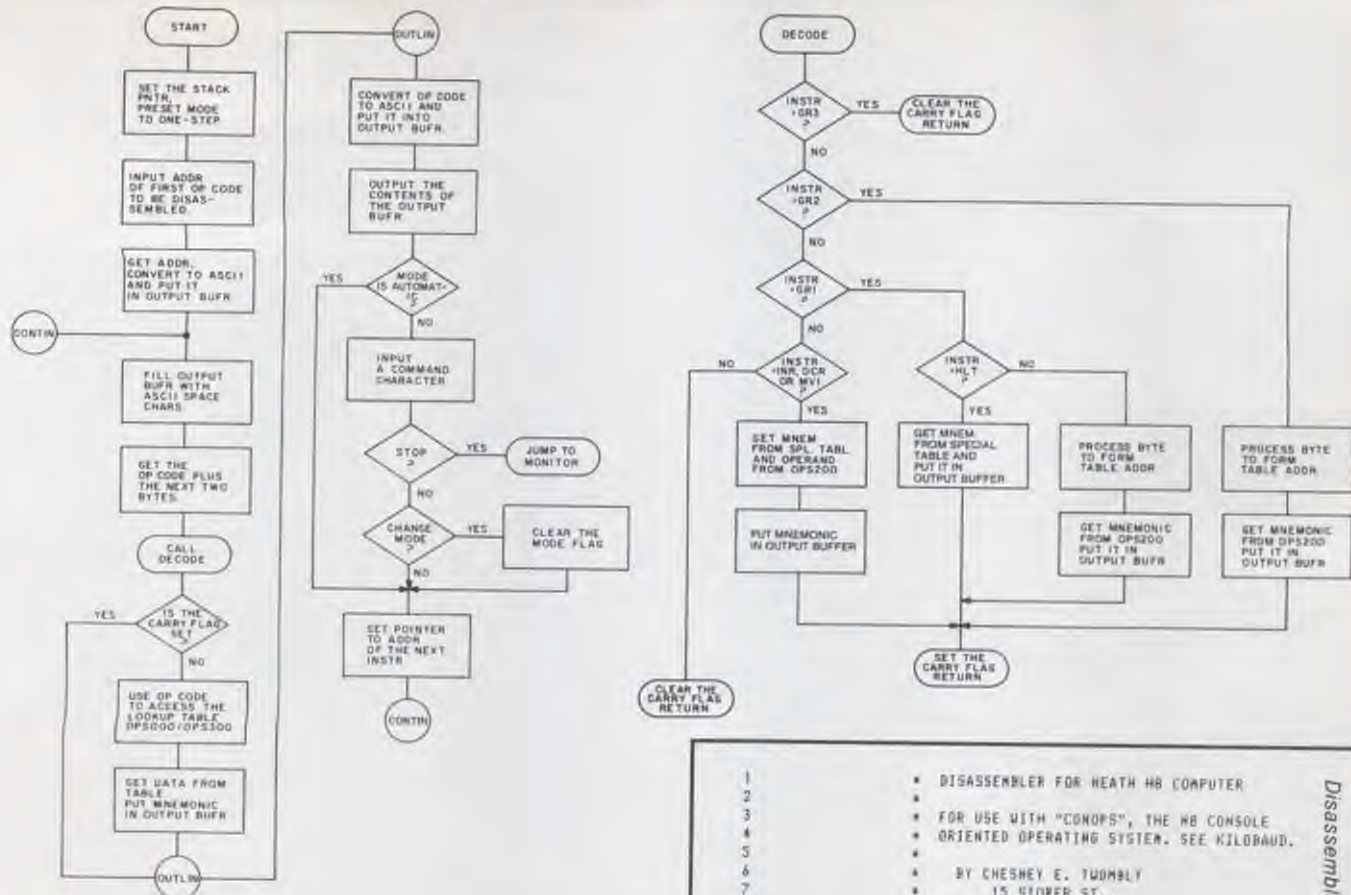


Fig. 3. Program flowchart.

In this program, the lookup tables have a total byte count of 606. The large, general table, OPS000/OPS300, has the arrangement shown in Fig. 1.

The index byte has a most significant bit of 1, which makes it identifiable as a non-mnemonic. The table is scanned starting at the high-end address—the location called STSCAN in the Disassembler program listing. When the index byte is encountered, the next byte down is an op code byte, which is compared with the instruction byte held in Reg A. When a match is found, the table pointer is advanced to decode the index byte and then to read the mnemonic and place it in the output buffer LIN. The table contains no spaces. Space information is in the index byte.

The index byte is encoded as shown in Fig. 2. MNEMONIC CNT is the total number of characters in the mnemonic, excluding spaces. It may be 2 to 7. SPACE CNT is the number of spaces between the main mnemonic word

and any appended operand. It may be zero to 3. INST CNT is the number of bytes in the instruction. It may be 1 to 3.

Two other tables are used. OPS200 serves the octal group 200-277 and is used, in a limited way, by groups 000 and 100. The remaining table supplies mnemonics for the instructions INR, DCR, MVI, MOV and HLT. OPS200 is accessed by the subroutines GET1, GET3 and ADDONE.

The flowchart in Fig. 3 gives an overall view of the program structure, which is simple and easy to follow. DECODE is a subroutine, with a return at the end of each branch. It is called by the main program and comes back with the status of the carry flag controlling the next step.

I have found the disassembler useful not only in the analysis of unknown programs, but also in checking for loading errors. You can add another code to your CONOPS jump table to select the disassembler. I use S for "Sammy." ■

```

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

```

* DISASSEMBLER FOR HEATH HB COMPUTER
* FOR USE WITH "CONOPS", THE HB CONSOLE
* ORIENTED OPERATING SYSTEM. SEE KILBAUD.
* BY CHESNEY E. TUMBLY
* 15 SIDOR ST.,
* KENNEBUNK ME 04043
* 2/11/79

OPT MNEMONIC

6F3E * ORG \$6F3E

6F80 STACK EQU \$6F80
6F84 MVI EQU \$6F84
6C03 PDATA EQU \$6C03
6C4C IN4H EQU \$6C4C
6C11 CRLF EQU \$6C11
6C19 INCHR EQU \$6C19
6ED8 RGRIT EQU \$6ED8
6C55 HEXL EQU \$6C55
6C59 HEXR EQU \$6C59

6F3E * NCMT DS 1
6F3F * MODE DS 1
6F40 * ADDR DS 2
6F42 * ADDR DS 2
6F44 * INST DS 1
6F45 * OPER DS 2
6F47 * NBR DS 1
6F48 * LIN DS 27H

67DF * ORG \$67DF

* MAIN PROGRAM

67DF 31 80 6F ENTER LXI SP, STACK
67E2 21 84 6D LXI H, MVI
67E5 CD 03 6C CALL PDATA
67E8 3E FF MVI A, \$FF
67EA 32 3F 6F STA MODE ;PRESET STEP MODE
67ED CD 4C 6C CALL IN4H ;GET START ADDR
67F0 EB XCHG
67F1 22 42 6F SHLD ADDR ;SAVE IT
67F4 E5 CONTIN PUSH H ;STACK < ADDR
67F5 CD 8E 69 CALL SPACES
67F8 E1 POP H
67F9 7E MOV A, H ;H, L < ADDR
67FA 32 44 6F STA INST ;SET OPR #1
67FB 23 INX H ;SAVE IT
67FE 7E MOV A, H ;GET OPR #2
67FF 32 45 6F STA OPER ;SAVE
6802 23 INX H
6803 7E MOV A, H ;GET OPR #3
6804 32 46 6F STA OPER+1 ;SAVE
6807 21 AB 6F LXI H, LIN ;PTR TO START OF BUF
680A 3A 43 6F LDA ADDR+1 ;GET ADDR #1 BYTE

Disassembler program.


```

61 8800 CD 71 69 CALL CBH ;CONV BINARY TO HEX
62 8810 3A 42 6F LDA ADDR ;LD BYTE
63 8813 CD 71 69 CALL CBH ;CONV AND PUT IN BUFR
64 8816 CD 89 68 CALL DECODE ;PROCESS BYTE
65 8819 DA 74 68 JC OUTLIN ;HAVE COMPLETE MNEMONIC
66
67 * ENTERED WHEN OP CODE REQUIRES USE OF
68 * TABLE OPS000 OR OPS300 TO GET MNEMONIC.
69
70 881C 21 CF 68 LXI H,STSCAN ;PTR TO SCAN START
71 881F 3A 44 6F LDA INST ;GET 1ST OP CODE BYTE
72 8822 F5 XSCAN PUSH PSW
73 8823 2B SCAN DCX H
74 8824 7E MOV A,H
75 8825 D6 80 SUI 80H ;INDEX BYTE TEST
76 8827 FA 23 68 JM SCAN ;NOT INDEX SO LOOP
77 882A F1 POP PSW
78 882B 2B DCX H ;PTR TO OP CODE BYTE
79 882C 8E CMP H ;COMPARE 1ST INSTRUCTION BYTE
80 882D CA 33 68 JZ FOUND ;TO TABLE OP CODE BYTE.
81 8830 C3 22 68 JMP XSCAN ;LOOK FOR NEXT OP CODE BYTE
82
83 8833 23 * FOUND INX H
84 8834 7E MOV A,H ;GET INDEX BYTE FROM TABLE
85 8835 F5 PUSH PSW
86 8836 F5 PUSH PSW
87 8837 E6 07 ANI 7 ;GET MNEM BYTE COUNT
88 8839 32 3E 6F STA MCNT ;SAVE IT HERE
89 883C 47 MOV B,A ;AND HERE
90 883D F1 POP PSW ;GET INSTR BYTE
91 883E 0F RRC
92 883F 0F RRC
93 8840 0F RRC
94 8841 E6 03 ANI 3 ;GET SPACE COUNT
95 8843 47 MOV B,A
96 8844 4F MOV C,A
97 8845 3E 05 MVI A,5 ;COMPUTE # BYTES IN
98 8847 90 SUB B ;MNEMONIC MAIN WORD.
99 8848 47 MOV B,A ;SAVE WORD COUNT IN B
100 8849 F1 POP PSW
101 884A C5 PUSH B
102 884B 07 RLC
103 884C 07 RLC
104 884D 07 RLC
105 884E E6 03 ANI 3
106 8850 32 47 6F STA HRR
107
108 * TAKE MNEMONIC FROM LOOK-UP TABLE
109 * AND PUT IT INTO OUTPUT BUFFER (LIN).
110 * INSERT ANY REQUIRED SPACES.
111
112 8853 11 62 6F LXI D,LIN+26
113 8856 23 INX H
114 8857 7E MOV A,H
115 8858 12 STAX D
116 8859 13 INX D
117 885A 05 DCR B
118 885B C2 56 68 JNZ CHAR
119 885E 13 SPAC INX D
120 885F 00 DCR C
121 8860 C2 5E 68 JNZ SPAC
122 8863 3A 3E 6F LDA MCNT
123 8866 C1 POP B
124 8867 90 SUB B
125 8868 CA 74 68 JZ OUTLIN
126 886B 87 MOV B,A
127 886C 23 INX H
128 886D 7E MOV A,H
129 886E 12 STAX B
130 886F 13 INX D
131 8870 05 DCR B
132 8871 C2 6C 68 JNZ APWD
133
134 * PUT INSTRUCTION CODE INTO OUTPUT
135 * BUFR AND PRINT CONTENTS OF BUFFER.
136
137 8874 3A 47 6F OUTLIN LDA HRR
138 8877 47 MOV B,A
139 8878 11 44 6F LXI D,INST
140 887B 21 4E 6F LXI H,LIN+6
141 887E 1A ANOTH LDAX D
142 887F CD 71 69 CALL CBH
143 8882 05 DCR B
144 8883 13 INX D
145 8884 23 INX H
146 8885 E5 PUSH H
147 8886 2A 42 6F LHLD ADDR
148 8889 23 INX H
149 888A 22 42 6F SHLD ADDR
150 888D E1 POP H
151 888E C2 7E 68 JNZ ANOTH
152 8891 CD 11 6C CALL CRLF ;ALL DATA IN LIN
153 8894 21 48 6F LXI H,LIN ;PREPARE TO OUTPUT IT.
154 8897 CD 03 6C CALL PDATA
155 889A 3A 3F 6F LDA MODE
156 889D FE FF CPI 0FF ;TEST MODE BYTE
157 889F C2 83 68 JNZ AUTO ;00 INDICATES AUTOMATIC
158 88A2 CD 1D 6C CALL INCHR ;WAIT FOR OPER CMD
159 88A5 FE 53 CPI 5 ;TEST FOR STOP CMD
160 88A7 CA 0B 6E JZ NOWIT
161 88AA FE 41 CPI 1 ;TEST FOR AUTO CMD. AUTO
162 88AC C2 83 68 JNZ AUTO ;MODE CAN BE EXITED ONLY BY

```

```

163 88AF AF XRA A ;HARDWARE RESET.
164 88B0 32 3F 6F STA MODE
165 88B3 2A 42 6F LHLD ADDR
166 88B6 C3 F4 67 JMP CONTIN
167
168 * INSTR CODE #1 BYTE IS CLASSIFIED TO
169 * DETERMINE WHICH PROCESSING ROUTINE
170 * WILL BE USED TO GET MNEMONIC AND BYTE
171 * COUNT. RETURN TO CALLING PROGRAM.
172
173 88B9 3E 01 DECODE MVI A,1
174 88BB 32 47 6F STA HRR
175 88BE 3A 44 6F LDA INST
176 88C1 07 RLC
177 88C2 07 RLC
178 88C3 E6 03 ANI 3
179 88C5 D6 02 SUI 2
180 88C7 CA 3A 69 JZ GR2
181 88CA F0 RA
182 88CB C6 01 ADI 1
183 88CD CA 06 69 JZ DR1
184
185 88D0 3A 44 6F GR0 LDA INST
186 88D3 E6 07 ANI 7
187 88D5 FE 04 CF1 4 ;TEST FOR INR
188 88D7 C2 E3 68 JNZ TDCR
189 88DA 11 F0 68 LXI D,INR
190 88DD CD 60 69 CALL GET3
191 88E0 C3 7E 69 JMP ADDONE
192
193 88E3 FE 05 TDCR CPI 5
194 88E5 C2 F1 68 JNZ TMVI
195 88E8 11 F3 68 LXI D,DCR
196 88EB CD 60 69 CALL GET3
197 88EE C3 7E 69 JMP ADDONE
198
199 88F1 FE 06 TMVI CPI 6
200 88F3 C2 04 69 JNZ GR000
201 88F6 3E 02 MVI A,2
202 88F8 32 47 6F STA HRR
203 88FB 11 F6 68 LXI D,MVI
204 88FE CD 60 69 CALL GET3
205 8901 C3 7E 69 JMP ADDONE
206
207 8904 A7 GR000 ANA A ;CLEAR CARRY
208 8905 C9 RET
209
210 8906 3A 44 6F DR1 LDA INST
211 8909 FE 76 CPI 076 ;TEST FOR HLT
212 890B C2 16 69 JNZ ISMOV
213 890E 11 FC 68 LXI D,HLT
214 8911 CD 60 69 CALL GET3
215 8914 37 STC
216 8915 C9 RET
217
218 8916 F5 ISMOV PUSH PSW
219 8917 F5 PUSH PSW
220 8918 11 F9 68 LXI B,MOV
221 891B CD 60 69 CALL GET3
222 891E F1 POP PSW
223 891F E6 38 ANI 038
224 8921 0F RRC
225 8922 0F RRC
226 8923 0F RRC
227 8924 CD 54 69 CALL GET1
228 8927 32 67 6F STA LIN+31
229 892A 3E 2C MVI A,2C
230 892C 32 68 6F STA LIN+32
231 892F F1 POP PSW
232 8930 E6 07 ANI 7
233 8932 CD 54 69 CALL GET1
234 8935 32 69 6F STA LIN+33
235 8938 37 STC
236 8939 C9 RET
237
238 893A 3A 44 6F GR2 LDA INST
239 893D F5 PUSH PSW
240 893E 11 00 68 LXI D,OPS200
241 8941 E6 38 ANI 038
242 8943 0F RRC
243 8944 0B ABC E
244 8945 5F MOV E,A
245 8946 CD 60 69 CALL GET3
246 8949 F1 POP PSW
247 894A E6 07 ANI 7
248 894C CD 54 69 CALL GET1
249 894F 32 67 6F STA LIN+31
250 8952 37 STC
251 8953 C9 RET
252
253 8954 11 00 68 GET1 LXI D,OPS200
254 8957 13 INX D
255 8958 13 INX B
256 8959 13 INX D
257 895A 07 RLC
258 895B 07 RLC
259 895C 0B ABC E
260 895D 5F MOV E,A
261 895E 1A LDAX D
262 895F C9 RET
263
264 8960 06 03 GET3 MVI B,3

```



```

265 6962 21 62 6F LXI H,LIN+26
266 6965 1A D D
267 6966 77 MOV M,A
268 6967 13 INX D
269 6968 23 INX H
270 6969 05 DCR D
271 696A CA 70 69 JZ DOME
272 696D C3 65 69 JMP GETHOR
273 6970 C9 DOME RET
274 *
275 * CONVERT BINARY BYTE IN REG A TO 2 HEX
276 * CHARS. SAVE IN ADDR POINTED TO BY H,L.
277 *
278 6971 F5 CBH PUSH PSW
279 6972 CD 55 6C CALL HEXL
280 6975 77 MOV M,A
281 6976 F1 POP PSW
282 6977 23 INX H
283 6978 CD 59 6C CALL HEXH
284 697B 77 MOV M,A
285 697C 23 INX H
286 697D C9 RET
287 *
288 697E 3A 44 6F ADDONE LDA INST
289 6981 E6 38 ANI 130
290 6983 1F RAR
291 6984 1F RAR
292 6985 1F RAR
293 6986 CD 54 69 CALL BETI
294 6989 32 67 6F STA LIN+31
295 698C 37 STC
296 698D C9 RET
297 *
298 * FILL OUTPUT BUFR WITH ASCII SPACE CHARS.
299 *
300 698E 21 40 6F SPACES LXI H,LIN
301 6991 06 27 MVI D,127
302 6993 36 20 SP MVI M,120
303 6995 05 DCR D
304 6996 23 INX H
305 6997 C2 93 69 JNZ SP
306 699A 3E 04 RVI A,4 ;END OF LINE CHAR
307 699C 32 67 6F STA LIN+39
308 699F C9 RET
309 *
310 69A0 DRG 69A0
311 *
312 * MNEMONIC LOOK-UP TABLES.
313 *
314 * OPS000
315 69A0 00 03 DB 0,003
316 69A2 4E 4F 50 DB 1,00F
317 69A5 01 F4 DB 1,0F4
318 69A7 4C 50 49 DB 1,0X10
319 69AA 42 DB 2,0AD
320 69AB 53 54 41 DB 1,0TAX0
321 69B2 03 04 DB 3,004
322 69B4 49 4E 50 DB 1,0X00
323 69B7 42 DB 7,003
324 69BA 52 4C 43 DB 0,003
325 69BD 08 03 DB 0,003
326 69BF 2A 2A 2A DB 0,000
327 69C2 09 04 DB 0,004
328 69C4 44 41 44 DB 0,0AD0
329 69C8 0A AD DB 0A,0AD
330 69CA 4C 44 41 DB 0,0AD0
331 69CD 58 42 DB 0B,004
332 69CF 08 04 DB 0C,004
333 69D1 44 43 50 DB 0C,004
334 69D5 0F 03 DB 0F,003
335 69D7 52 52 43 DB 0,000
336 69DA 10 03 DB 0,003
337 69DC 2A 2A 2A DB 0,000
338 69DF 11 F4 DB 0,0F4
339 69E1 4C 50 49 DB 0,0X10
340 69E3 12 AD DB 0,0AD
341 69E7 53 54 41 DB 0,0AD0
342 69EA 58 44 DB 0B,004
343 69EC 13 04 DB 0C,004
344 69EE 49 4E 50 DB 0,0X00
345 69F2 17 03 DB 0,003
346 69F4 52 41 4C DB 0,0AD0
347 69F7 18 03 DB 0,003
348 69F9 2A 2A 2A DB 0,000
349 69FC 19 04 DB 0,004
350 69FE 44 41 44 DB 0,0AD0
351 6A02 1A AD DB 0A,0AD
352 6A04 4C 44 41 DB 0,0AD0
353 6A07 58 44 DB 0B,004
354 6A09 18 04 DB 0C,004
355 6A0B 44 43 50 DB 0,0X00
356 6A0E 44 DB 0,004
357 6A10 1F 03 DB 0F,003
358 6A12 52 41 52 DB 0,0AD0

```

```

359 6A14 20 03 DB 0,003
360 6A16 2A 2A 2A DB 0,000
361 6A19 21 F4 DB 0,0F4
362 6A1B 4C 50 49 DB 0,0X10
363 6A1E 48 DB 0,000
364 6A1F 22 EC DB 0,0EC
365 6A21 53 48 4C DB 0,0X10
366 6A24 44 DB 0,004
367 6A25 23 04 DB 0,003
368 6A27 49 4E 50 DB 0,0X00
369 6A2A 48 DB 0,000
370 6A2B 27 03 DB 0,003
371 6A2D 44 41 41 DB 0,0AD0
372 6A2F 28 03 DB 0,003
373 6A32 2A 2A 2A DB 0,000
374 6A35 29 04 DB 0,004
375 6A37 44 41 44 DB 0,0AD0
376 6A3A 48 DB 0,000
377 6A3B 2A EC DB 0,0EC
378 6A3D 4C 48 4C DB 0,0X10
379 6A40 44 DB 0,004
380 6A41 29 04 DB 0,003
381 6A43 44 43 50 DB 0,0X00
382 6A46 48 DB 0,000
383 6A47 2F 03 DB 0,003
384 6A49 2A 2A 2A DB 0,000
385 6A4C 31 F5 DB 0,0F5
386 6A4E 4C 50 49 DB 0,0X10
387 6A51 53 50 DB 0,000
388 6A53 32 F3 DB 0,0F3
389 6A55 53 54 41 DB 0,0AD0
390 6A58 33 05 DB 0,005
391 6A5A 49 4E 50 DB 0,0X00
392 6A5D 53 50 DB 0,000
393 6A5F 37 03 DB 0,003
394 6A61 53 54 43 DB 0,0AD0
395 6A64 38 03 DB 0,003
396 6A66 2A 2A 2A DB 0,000
397 6A69 39 05 DB 0,005
398 6A6B 44 41 44 DB 0,0AD0
399 6A6E 53 50 DB 0,000
400 6A70 3A F3 DB 0,0F3
401 6A72 4C 44 41 DB 0,0AD0
402 6A75 38 05 DB 0,005
403 6A77 44 43 50 DB 0,0X00
404 6A7A 53 50 DB 0,000
405 6A7C 3F 03 DB 0,003
406 6A7E 43 4D 43 DB 0,0X00
407 6A81 C0 03 DB 0,003
408 6A83 52 4E 5A DB 0,0X2
409 6A86 C1 04 DB 0,0C1
410 6A88 50 4F 50 DB 0,00F
411 6A8B 42 DB 0,000
412 6A8C C2 F3 DB 0,0F3
413 6A8E 4A 4E 5A DB 0,0X2
414 6A91 C3 F3 DB 0,0F3
415 6A93 4A 4D 50 DB 0,0X1
416 6A96 C4 F3 DB 0,0F3
417 6A98 43 4E 5A DB 0,0X2
418 6A9B C5 AD DB 0,0C5
419 6A9D 50 55 53 DB 0,005
420 6AA0 48 42 DB 0,000
421 6AA2 C6 D3 DB 0,0D3
422 6AA4 41 44 49 DB 0,0AD0
423 6AA7 C7 04 DB 0,0C7
424 6AA9 52 53 54 DB 0,005
425 6AAC 30 DB 0,000
426 6AAD C8 0A DB 0,0C8
427 6AAF 52 5A DB 0,0X2
428 6AB1 C9 03 DB 0,0C9
429 6AB3 52 45 54 DB 0,0X2
430 6AB6 CA FA DB 0,0CA
431 6AB8 4A 5A DB 0,0X2
432 6ABA CB 03 DB 0,0CB
433 6ABC 2A 2A 2A DB 0,000
434 6ABF CC FA DB 0,0CC
435 6AC1 43 5A DB 0,0C1
436 6AC3 CD EC DB 0,0CD
437 6AC5 43 41 4C DB 0,0X1
438 6AC8 4C DB 0,000
439 6AC9 CE 03 DB 0,0CE
440 6ACB 41 43 49 DB 0,0CB
441 6ACE CF 04 DB 0,0CF
442 6AD0 52 53 5A DB 0,005
443 6AD3 31 DB 0,003
444 6AD4 D0 03 DB 0,0D0
445 6AD6 52 4E 43 DB 0,0X2
446 6AD9 D1 04 DB 0,0D1
447 6ADD 50 4F 50 DB 0,00F
448 6ADE 44 DB 0,000
449 6ADF D2 F3 DB 0,0F3
450 6AE1 4A 4E 43 DB 0,0X2
451 6AE4 D3 D3 DB 0,0D3
452 6AE6 4F 55 54 DB 0,005
453 6AE9 D4 F3 DB 0,0F3
454 6AEB 43 4E 43 DB 0,0X2
455 6AEE D5 AD DB 0,0D5
456 6AF0 50 55 53 DB 0,005
457 6AF3 48 44 DB 0,000
458 6AF5 D6 D3 DB 0,0D6
459 6AF7 53 55 49 DB 0,005

```


440	6AFA D7 B4	DB	6D7, 6B4
441	6AFC 52 53 54	DB	RST2
	6AFF 32		
442	6B00 08 BA	DB	6B0, 6BA
443	6B02 52 43	DB	RC
444	6B04 D9 B3	DB	6D9, 6B3
445	6B06 2A 2A 2A	DB	***
446	6B08 DA FA	DB	6DA, 6FA
447	6B0A 4A 43	DB	JC
448	6B0C 0B DA	DB	6B0, 6DA
449	6B0E 49 4E	DB	IN
450	6B10 DC FA	DB	6DC, 6FA
451	6B12 43 43	DB	CC
452	6B14 D0 B3	DB	6B0, 6B3
453	6B16 2A 2A 2A	DB	***
454	6B1A DE D3	DB	6DE, 6D3
455	6B1C 53 42 49	DB	SBI
456	6B1E DF B4	DB	6DF, 6B4
457	6B20 52 53 54	DB	RST3
	6B24 33		
458	6B26 E0 B3	DB	6E0, 6B3
459	6B28 52 50 4F	DB	RP0
460	6B2A E1 B4	DB	6E1, 6B4
461	6B2C 50 4F 50	DB	POPN
	6B2F 40		
462	6B30 E2 F3	DB	6E2, 6F3
463	6B32 4A 50 4F	DB	JPO
464	6B34 E3 AC	DB	6E3, 6AC
465	6B36 50 54 48	DB	XTNL
	6B3A 4C		
466	6B3B E4 F3	DB	6E4, 6F3
467	6B3D 43 50 4F	DB	CP0
468	6B3F E5 AD	DB	6E5, 6AD
469	6B41 50 55 53	DB	PUSHH
	6B45 48 48		
470	6B47 E6 D3	DB	6E6, 6D3
471	6B49 41 4E 49	DB	WHI
472	6B4C E7 B4	DB	6E7, 6B4
473	6B4E 52 53 54	DB	RST4
	6B51 34		
474	6B52 E8 B3	DB	6E8, 6B3
475	6B54 52 50 45	DB	RPE
476	6B56 E9 AC	DB	6E9, 6AC
477	6B58 50 43 48	DB	PCHL
	6B5C 4C		
478	6B5D EA F3	DB	6EA, 6F3
479	6B5F 4A 50 45	DB	JPE
480	6B62 EB AC	DB	6EB, 6AC
481	6B64 58 43 48	DB	XCHG
	6B67 47		
482	6B68 EC F3	DB	6EC, 6F3
483	6B6A 43 50 45	DB	CPE
484	6B6C ED B3	DB	6ED, 6B3
485	6B6E 2A 2A 2A	DB	***
486	6B70 EE B3	DB	6EE, 6B3
487	6B72 5B 52 49	DB	XRI
488	6B74 EF B4	DB	6EF, 6B4
489	6B76 52 53 54	DB	RST5
	6B7C 35		
490	6B7D F0 BA	DB	6FA, 6BA
491	6B7F 52 50	DB	RP
492	6B81 F1 B4	DB	6F1, 6B4
493	6B83 50 4F 50	DB	POPPSW
	6B86 50 53 57		
494	6B89 F2 FA	DB	6F2, 6FA
495	6B8B 4A 50	DB	JP
496	6B8D F3 BA	DB	6F3, 6BA
497	6B8F 44 49	DB	DI
498	6B91 F4 FA	DB	6F4, 6FA
499	6B93 43 50	DB	CP
500	6B95 F5 AF	DB	6F5, 6AF
501	6B97 50 55 53	DB	PUSHPSW
	6B9A 48 50 53		
	6B9D 57		
502	6B9E F6 D3	DB	6FE, 6D3
503	6BA0 4F 52 49	DB	DRI
504	6BA3 F7 B4	DB	6F7, 6B4
505	6BA5 52 53 54	DB	RST6
	6BA8 36		
506	6BA9 F8 BA	DB	6FB, 6BA
507	6BAB 52 4D	DB	RM
508	6BAD F9 AC	DB	6F9, 6AC
509	6BAF 53 50 40	DB	SPHL
	6BB2 4C		
510	6BB3 FA FA	DB	6FA, 6FA
511	6BB5 4A 4D	DB	JM
512	6BB7 F9 BA	DB	6FB, 6BA
513	6BB9 45 49	DB	EI
514	6BBB FC FA	DB	6FC, 6FA
515	6BBD 43 4D	DB	CM
516	6BBF FD B3	DB	6FD, 6B3
517	6BC1 2A 2A 2A	DB	***
518	6BC4 FE B3	DB	6FE, 6B3
519	6BC6 43 50 49	DB	CPI
520	6BC9 FF B4	DB	6FF, 6B4
521	6BCB 52 53 54	DB	RST7
	6BCE 37		
522		*	
523	6BCF	STSCAN	DS
524		*	
525	6BD0 41 44 44	OPS200	DB
	6BD3 42		ADD8

526	6BD4 41 44 43	DB	ADCC
	6BD7 43		
527	6BD8 53 55 42	DB	SUBB
	6BD8 44		
528	6BD9 53 42 42	DB	SBBE
	6BDF 45		
529	6BE0 41 4E 41	DB	ANAH
	6BE3 48		
530	6BE4 50 52 41	DB	XRAL
	6BE7 4C		
531	6BE8 4F 52 41	DB	ORAM
	6BE8 4D		
532	6BEC 43 4D 50	DB	CAFA
	6BEF 41		
533		*	
534	6BF0 49 4E 52	INR	DB
535	6BF3 44 43 52	DCR	DB
536	6BF6 4D 50 49	MVI	DB
537		*	
538	6BF9 4D 4F 56	MOV	DB
539	6BFC 4B 4C 54	HLT	DB
540		*	
541			END

SYMBOL TABLE:

ADDN	6F40	ADDONE	697E	ADDR	6F42	AMOTH	687E	APND	686C
AUTO	68B3	CBH	6971	CHAR	6856	CONTIM	67FA	CRLF	6C11
DCR	68F3	DECODE	68B9	DOME	6870	ENTER	67DF	FOUND	6833
GET1	6954	GET3	6940	GETHOR	6965	GR0	68D0	GR000	6904
GR1	6986	GR2	693A	HEXL	6C55	HEXR	6C59	HLT	68FC
IMAH	6C4C	INCHR	6C1D	INR	68F0	INS1	6F44	ISMOV	6916
LIN	6F48	NCHT	6F3E	MODE	6F3F	MONIT	6EDB	MOV	68F9
MS1	6DB4	MVI	68FA	NBR	6F47	OPER	6F45	OPS200	68D0
OUTLIN	6874	PDATA	6C03	SCAN	6B23	SP	6993	STAC	685E
SPACES	698E	STACK	6F80	STSCAN	6BCF	TDCR	68E3	TAVI	68F1
XSCAN	6822								

Note: CONOPS works only with the H8 console driver as originally supplied by Heath. The new console driver, used in the H8-18 software package (Heath's #890-3-3), is different and I don't know how to use it yet.

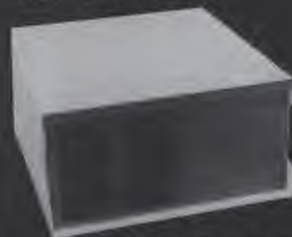
Main/Frames from \$200

Main/Frames from \$200

- 14 Basic Models Available
- Assembled & Tested
- Power Supply: 8v@15A, ± 16v@3A
- 15 Slot Motherboard (connectors optional)
- Card cage & guides
- Fan, line cord, fuse, power & reset switches, EMI filter
- 8v@30A, ± 16v@10A option on some models



Rack mounted from \$200



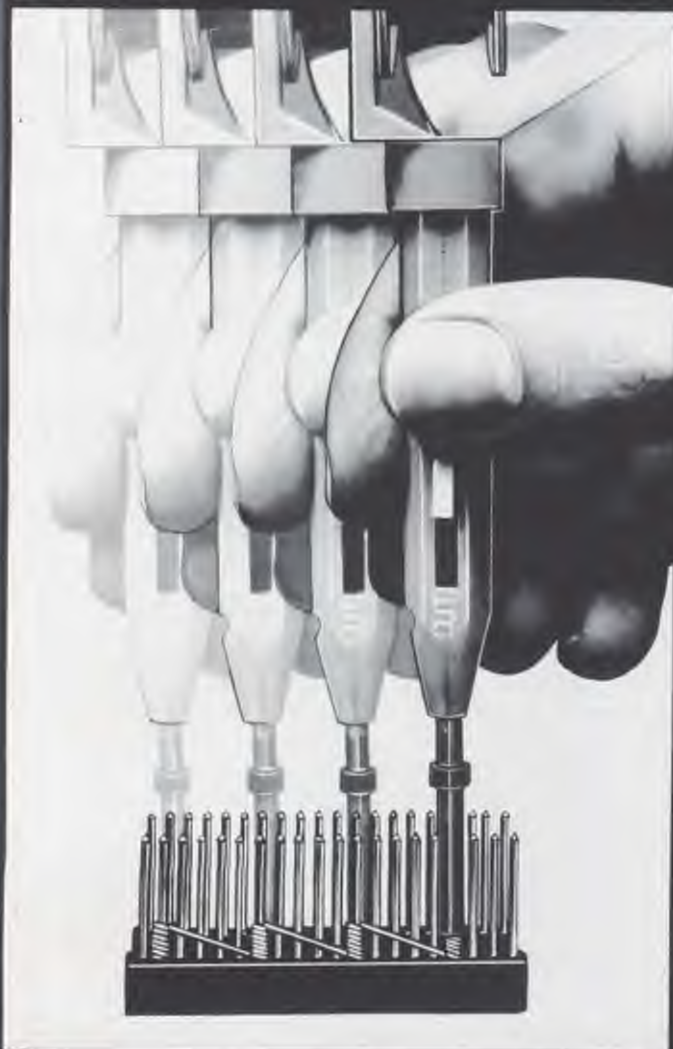
8" Floppy Main/Frame (includes power for drives and mainframe) from \$365

Write or call for our brochure which includes our application note: 'Building Cheap Computers'

✓113 INTEGRAND

8474 Ave. 296 • Visalia, CA 93277 • (209) 733-9288
We accept BankAmericard/Visa and MasterCard

NEW!



**WHY CUT?
WHY STRIP?
WHY SLIT?**

WHY NOT...

JUST WRAP™



U.S.A.
FOREIGN
PATENTS
PENDING

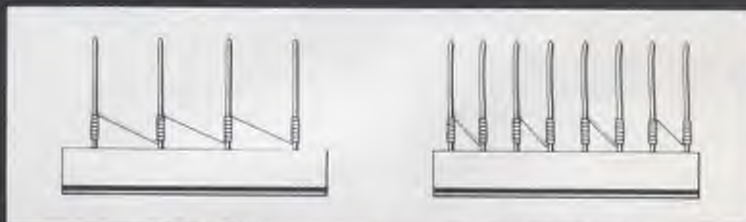
- AWG 30 Wire
- .025" Square Posts
- Daisy Chain or Point To Point
- No Stripping or Slitting Required

....JUST WRAP™....

- Built In Cut Off
- Easy Loading of Wire
- Available Wire Colors:
Blue, White, Red & Yellow

***\$14⁹⁵**

JUST WRAP TOOL WITH ONE 50 FT. ROLL OF WIRE		
COLOR	PART NO.	U.S. LIST PRICE
BLUE	JW-1-B	\$14.95
WHITE	JW-1-W	14.95
YELLOW	JW-1-Y	14.95
RED	JW-1-R	14.95
REPLACEMENT ROLL OF WIRE 50 FT.		
BLUE	R-JW-B	2.98
WHITE	R-JW-W	2.98
YELLOW	R-JW-Y	2.98
RED	R-JW-R	2.98



DAISY CHAIN

POINT TO POINT



MACHINE & TOOL CORPORATION 3455 CONNER ST., BRONX, N.Y. 10475 (212) 994-6600/TELEX 125091

*MINIMUM BILLING \$25.00 / AD SHIPPING CHARGE \$2.00 / NEW YORK CITY / STATE RESIDENTS ADD APPLICABLE TAX.

Software Clock for the 6800

With this routine, you have instant access to the correct date and time—in ASCII format.

```

*      SOFTWARE CLOCK PROGRAM
*
A000      EQU      $A000      PIA B PORT DATA REGISTER
B101      EQU      $B101      PIA CONTROL REGISTER B PORT
B300      EQU      $B300      ACIA CONTROL AND STATUS REGISTER
B301      EQU      $B301      DATA REGISTER OF ACIA
*
D000      EQU      $D000      VARIABLE TO COUNT 60 HZ INTERRUPT
D001      EQU      $D001      KTIME
D002      EQU      $D002      UDAY
D003      EQU      $D003      TDAY
D004      EQU      $D004      UMSN
D005      EQU      $D005      HR
D006      EQU      $D006      MIN
D007      EQU      $D007      SEC
D008      EQU      $D008      MS
D009      EQU      $D009      DAY
D010      EQU      $D010      YR
D011      EQU      $D011      DT
D012      EQU      $D012      THRS
D013      EQU      $D013      UHRS
D014      EQU      $D014      TRIV
D015      EQU      $D015      UMIN
D016      EQU      $D016      TSEC
D017      EQU      $D017      USEC
D018      EQU      $D018      TMSN
D019      EQU      $D019      UMSN
D020      EQU      $D020      TDAY
D021      EQU      $D021      UDAY
D022      EQU      $D022      TYRS
D023      EQU      $D023      UYRS
D024      EQU      $D024      ODD
D025      EQU      $D025      ODA
D026      EQU      $D026      ODA
D027      EQU      $D027      ODA
D028      EQU      $D028      ODA
D029      EQU      $D029      ODA
D030      EQU      $D030      ODA
D031      EQU      $D031      ODA
D032      EQU      $D032      ODA
D033      EQU      $D033      ODA
D034      EQU      $D034      ODA
D035      EQU      $D035      ODA
D036      EQU      $D036      ODA
D037      EQU      $D037      ODA
D038      EQU      $D038      ODA
D039      EQU      $D039      ODA

```

Listing 1. Assignment of variables for the remainder of the program. A terminal interfaced to an ACIA at \$B300 is indicated, as well as a PIA at \$B101 through which the interrupts are serviced. The ASCII time and date sentence is shown beginning at \$D022.

Whenever a computer is interfaced to the real world via sensors or a controllable device, there is often a need for the computer to know what time it is. Controlling a particular device at a specific time is one such use (for example, turning home lights on or off).

Another use might be appending the time to a particular event. My need fell into this latter category. In my computer-controlled security system, I am able to append both the time and the date to an event. For example, if the telephone or doorbell rings, the event will be noted on a printer along with the time and date.

My second need for a real-time clock was for an amateur radioteletype program. In this case, I wanted the computer to insert the time and date when I typed a particular control character. This article is the result of my labors and should prove useful to others, for it is, in some ways, a unique real-time clock program.

Program Description

Three characteristics of the program make it unique from many of the other articles writ-

ten on the subject. The salient difference between this program and many of the others lies in the format in which the time is stored. Most programs store the time in packed BCD form.

At first, you might think that this is an efficient manner in which to store the time, for it requires very little memory. However, the disadvantage is that several other routines are required to retrieve the time, and print is in a form that can be read on paper. For example, the packed BCD digits must be separated, converted to ASCII, and then colons, spaces, slashes and perhaps a carriage return and line feed must be added to give the necessary readable output format.

The format used in this program has all the necessary characters and commands, and all you have to do is access the string of continuous addresses whenever the time and date are required. In essence, this format is a sentence that can be appended to virtually any event (for example, 12:17:36 06/21/79).

A second characteristic of this program is that it contains the month, day and year information, which most other programs lack. This is a particularly important feature for a security system or any other continuously run system. Only during a leap year or a new decade is there a need for human intervention. However, it's obvious that a little extra programming could ob-

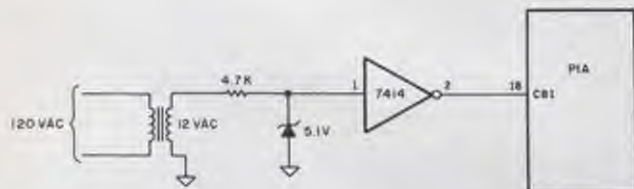


Fig. 1. The timebase for the software real-time clock can be derived from the commercial power line timebase of 60 Hz. The program allows virtually any other frequency to be used as well.

viate this requirement.

The third difference is the way in which the time is initialized. Most other programs that I have seen require the user to access particular memory locations and insert the time and date in packed BCD form employing the user's operating system.

The method used in this program is far simpler and quicker. All the necessary prompts are given so that there is little chance for error. For example, the time indicated above could have been initialized by the following:

```
HR 4612
MIN 517
SEC 36
MO 06
DAY 21
YR 7879
```

When the program begins, the computer will respond by printing the HR prompt on the terminal, at which time the operator inserts the hour desired. If you make an error, merely continue by inserting the correct hour. The program has been written to accept only the last two digits. For example, in the above example, 12 hours rather than 46 will be the starting time. Likewise, the number of minutes will be 17, and the year 79.

When the correct digits have been inserted after a particular prompt, a carriage return will bring up the next prompt. The program has been written so that only valid ASCII numbers will be accepted, in other words, alpha or control characters will not be inserted or echoed back to the terminal. The carriage return after the YR prompt will clear the interrupt mask bit, which was set upon entrance into the program, and the MPU will begin servicing interrupts.

Therefore, the time can be initialized, and when that moment actually occurs, a carriage return command will synchronize the program with the real time. Since an IRQ interrupt, rather than an NMI interrupt, is used, there is no need to inhibit pulses during the loading or initialization of the program.

Finally, the program does not make any calls to the user's operating system subroutines such as MIKBUG's OUT2HS or PDATA1. For this reason, the

program is independent of the user's operating system, and, therefore, it should be compatible with virtually any system using the 6800.

With initialization complete, the program branches to the CHRIN subroutine, which waits for a character from the terminal. If the character is a T, the time and date sentence is printed. This is the clock demonstration routine and is included for testing purposes. When the user is satisfied with the opera-

tion of the program, control should be transferred to the user's main program rather than the clock demonstration routine, which begins at \$0869.

Hardware

Before you implement a real-time clock, you should first determine whether it will be a hardware or software clock. Each has its advantages and disadvantages. Briefly, the salient advantage of the software clock is the cost. Since there is virtually

no hardware required, there is essentially no cost involved. On the other hand, a software clock does require more memory than a hardware clock, and it typically uses more of the computer's time. This impediment is so slight as to be nonexistent (more on this later).

The hardware clock is more advantageous when the computer is not run continuously, since loading and initialization are not required each time the computer is turned on. Since my

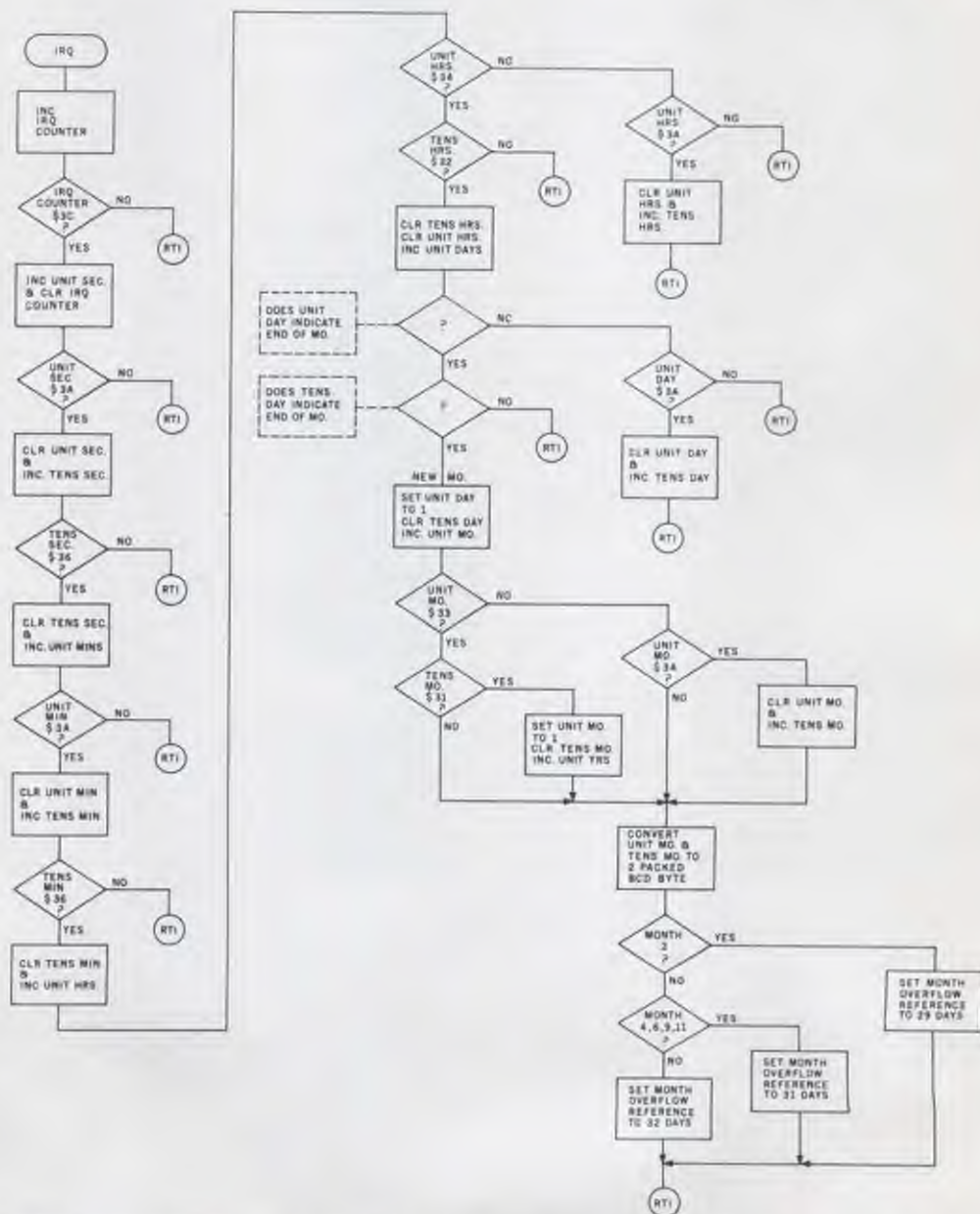


Fig. 2. Flowchart for the main portion of the program shown in listing 3. This, together with the comments in the listings, should allow non-6800 owners to design a similar program. Note that all variables are in ASCII and that, basically, the program checks for an overflow condition of the variables. For example, if units of seconds overflows from 9(\$39) to :(\$3A), there will then be a need to reset units of seconds back to 0(\$30) and increment tens of seconds and check for an overflow of 6(\$36).

security system computer is on continuously, the advantages of the software clock outweighed the disadvantages.

After deciding on a software clock, you must ask if the non-maskable interrupt (NMI) or the

interrupt request (IRQ) line of the 6800 should be used. Once again, each method has advantages and disadvantages.

The NMI interface method does not require an additional IC, such as a peripheral inter-

face adapter (PIA), since it interfaces directly to the 6800. However, this method can cause problems in some applications. For example, if an ongoing program uses the MPU for timing loops, the accuracy of the tim-

ing loop will be impaired due to the overhead time of the clock program.

A second deficiency of this method lies in the fact that there must be a means of disabling the interrupts (i.e., a switch) until the program is loaded. This can be partially overcome by burning the program into ROM, but then other problems arise since the NMI vectored address must also be in nonvolatile memory. While this is certainly possible, the flexibility of the computer system would be slightly impaired. Finally, a typical system has several IRQ inputs, but only one NMI input. Therefore, the NMI cannot be used for other purposes.

For these reasons, I used a "soft" interrupt (IRQ) via a PIA. More specifically, as shown in Fig. 1, the interrupts were interfaced via the CB1 control line of the PIA. The data register of the B port of this PIA is at \$8101, and the control register is at \$8109. Of course, any PIA can be used with the necessary addresses altered in the program. The program assumes that the system's terminal is interfaced to the MPU via an ACIA with control and status register at \$8300, and the data register at \$8301.

The timebase for the interrupts is derived from conventional 60 Hz commercial power. While virtually any timebase can be used, this timebase source has the advantage that it is accurate, reliable and readily available. Fig. 1 gives the details of the timebase circuit. A 12 V ac transformer is indicated, but a standard 6.3 V ac filament transformer should prove equally acceptable. The 7414 is a Schmitt trigger inverter, which provides the necessary hysteresis to prevent false interrupts due to power-line fluctuations.

The output of the circuit is a clean, TTL-compatible signal at a 60 Hz repetition rate. The software provides the necessary dividing to give a 1 Hz timebase for seconds. Note that the computer system will be more efficient with a lower interrupt rate. For example, assuming a 1 MHz MPU clock frequency, each time an interrupt occurs, approximately 100 microseconds are

```

0800 0F 0F      BEGIN  BRG  #850
0801 0F 0F00  LDX  #START
0802 0F 0F00  STX  #START
0803 0F 0F00  CLRA
0804 0F 0F00  STAA  #TIME
0805 0F 0F00  STAA  #PIAOCB
0806 0F 0F00  STAA  #PIAOCB
0807 0F 0F00  STAA  #PIAOCB
0808 0F 0F00  STAA  #PIAOCB
0809 0F 0F00  STAA  #PIAOCB
0810 0F 0F00  STAA  #PIAOCB
0811 0F 0F00  STAA  #PIAOCB
0812 0F 0F00  STAA  #PIAOCB
0813 0F 0F00  STAA  #PIAOCB
0814 0F 0F00  STAA  #PIAOCB
0815 0F 0F00  STAA  #PIAOCB
0816 0F 0F00  STAA  #PIAOCB
0817 0F 0F00  STAA  #PIAOCB
0818 0F 0F00  STAA  #PIAOCB
0819 0F 0F00  STAA  #PIAOCB
0820 0F 0F00  STAA  #PIAOCB
0821 0F 0F00  STAA  #PIAOCB
0822 0F 0F00  STAA  #PIAOCB
0823 0F 0F00  STAA  #PIAOCB
0824 0F 0F00  STAA  #PIAOCB
0825 0F 0F00  STAA  #PIAOCB
0826 0F 0F00  STAA  #PIAOCB
0827 0F 0F00  STAA  #PIAOCB
0828 0F 0F00  STAA  #PIAOCB
0829 0F 0F00  STAA  #PIAOCB
0830 0F 0F00  STAA  #PIAOCB
0831 0F 0F00  STAA  #PIAOCB
0832 0F 0F00  STAA  #PIAOCB
0833 0F 0F00  STAA  #PIAOCB
0834 0F 0F00  STAA  #PIAOCB
0835 0F 0F00  STAA  #PIAOCB
0836 0F 0F00  STAA  #PIAOCB
0837 0F 0F00  STAA  #PIAOCB
0838 0F 0F00  STAA  #PIAOCB
0839 0F 0F00  STAA  #PIAOCB
0840 0F 0F00  STAA  #PIAOCB
0841 0F 0F00  STAA  #PIAOCB
0842 0F 0F00  STAA  #PIAOCB
0843 0F 0F00  STAA  #PIAOCB
0844 0F 0F00  STAA  #PIAOCB
0845 0F 0F00  STAA  #PIAOCB
0846 0F 0F00  STAA  #PIAOCB
0847 0F 0F00  STAA  #PIAOCB
0848 0F 0F00  STAA  #PIAOCB
0849 0F 0F00  STAA  #PIAOCB
0850 0F 0F00  STAA  #PIAOCB
0851 0F 0F00  STAA  #PIAOCB
0852 0F 0F00  STAA  #PIAOCB
0853 0F 0F00  STAA  #PIAOCB
0854 0F 0F00  STAA  #PIAOCB
0855 0F 0F00  STAA  #PIAOCB
0856 0F 0F00  STAA  #PIAOCB
0857 0F 0F00  STAA  #PIAOCB
0858 0F 0F00  STAA  #PIAOCB
0859 0F 0F00  STAA  #PIAOCB
0860 0F 0F00  STAA  #PIAOCB
0861 0F 0F00  STAA  #PIAOCB
0862 0F 0F00  STAA  #PIAOCB
0863 0F 0F00  STAA  #PIAOCB
0864 0F 0F00  STAA  #PIAOCB
0865 0F 0F00  STAA  #PIAOCB
0866 0F 0F00  STAA  #PIAOCB
0867 0F 0F00  STAA  #PIAOCB
0868 0F 0F00  STAA  #PIAOCB
0869 0F 0F00  STAA  #PIAOCB
0870 0F 0F00  STAA  #PIAOCB
0871 0F 0F00  STAA  #PIAOCB
0872 0F 0F00  STAA  #PIAOCB
0873 0F 0F00  STAA  #PIAOCB
0874 0F 0F00  STAA  #PIAOCB
0875 0F 0F00  STAA  #PIAOCB
0876 0F 0F00  STAA  #PIAOCB
0877 0F 0F00  STAA  #PIAOCB
0878 0F 0F00  STAA  #PIAOCB
0879 0F 0F00  STAA  #PIAOCB
0880 0F 0F00  STAA  #PIAOCB
0881 0F 0F00  STAA  #PIAOCB
0882 0F 0F00  STAA  #PIAOCB
0883 0F 0F00  STAA  #PIAOCB
0884 0F 0F00  STAA  #PIAOCB
0885 0F 0F00  STAA  #PIAOCB
0886 0F 0F00  STAA  #PIAOCB
0887 0F 0F00  STAA  #PIAOCB
0888 0F 0F00  STAA  #PIAOCB
0889 0F 0F00  STAA  #PIAOCB
0890 0F 0F00  STAA  #PIAOCB
0891 0F 0F00  STAA  #PIAOCB
0892 0F 0F00  STAA  #PIAOCB
0893 0F 0F00  STAA  #PIAOCB
0894 0F 0F00  STAA  #PIAOCB
0895 0F 0F00  STAA  #PIAOCB
0896 0F 0F00  STAA  #PIAOCB
0897 0F 0F00  STAA  #PIAOCB
0898 0F 0F00  STAA  #PIAOCB
0899 0F 0F00  STAA  #PIAOCB
0900 0F 0F00  STAA  #PIAOCB
0901 0F 0F00  STAA  #PIAOCB
0902 0F 0F00  STAA  #PIAOCB
0903 0F 0F00  STAA  #PIAOCB
0904 0F 0F00  STAA  #PIAOCB
0905 0F 0F00  STAA  #PIAOCB
0906 0F 0F00  STAA  #PIAOCB
0907 0F 0F00  STAA  #PIAOCB
0908 0F 0F00  STAA  #PIAOCB
0909 0F 0F00  STAA  #PIAOCB
0910 0F 0F00  STAA  #PIAOCB
0911 0F 0F00  STAA  #PIAOCB
0912 0F 0F00  STAA  #PIAOCB
0913 0F 0F00  STAA  #PIAOCB
0914 0F 0F00  STAA  #PIAOCB
0915 0F 0F00  STAA  #PIAOCB
0916 0F 0F00  STAA  #PIAOCB
0917 0F 0F00  STAA  #PIAOCB
0918 0F 0F00  STAA  #PIAOCB
0919 0F 0F00  STAA  #PIAOCB
0920 0F 0F00  STAA  #PIAOCB
0921 0F 0F00  STAA  #PIAOCB
0922 0F 0F00  STAA  #PIAOCB
0923 0F 0F00  STAA  #PIAOCB
0924 0F 0F00  STAA  #PIAOCB
0925 0F 0F00  STAA  #PIAOCB
0926 0F 0F00  STAA  #PIAOCB
0927 0F 0F00  STAA  #PIAOCB
0928 0F 0F00  STAA  #PIAOCB
0929 0F 0F00  STAA  #PIAOCB
0930 0F 0F00  STAA  #PIAOCB
0931 0F 0F00  STAA  #PIAOCB
0932 0F 0F00  STAA  #PIAOCB
0933 0F 0F00  STAA  #PIAOCB
0934 0F 0F00  STAA  #PIAOCB
0935 0F 0F00  STAA  #PIAOCB
0936 0F 0F00  STAA  #PIAOCB
0937 0F 0F00  STAA  #PIAOCB
0938 0F 0F00  STAA  #PIAOCB
0939 0F 0F00  STAA  #PIAOCB
0940 0F 0F00  STAA  #PIAOCB
0941 0F 0F00  STAA  #PIAOCB
0942 0F 0F00  STAA  #PIAOCB
0943 0F 0F00  STAA  #PIAOCB
0944 0F 0F00  STAA  #PIAOCB
0945 0F 0F00  STAA  #PIAOCB
0946 0F 0F00  STAA  #PIAOCB
0947 0F 0F00  STAA  #PIAOCB
0948 0F 0F00  STAA  #PIAOCB
0949 0F 0F00  STAA  #PIAOCB
0950 0F 0F00  STAA  #PIAOCB
0951 0F 0F00  STAA  #PIAOCB
0952 0F 0F00  STAA  #PIAOCB
0953 0F 0F00  STAA  #PIAOCB
0954 0F 0F00  STAA  #PIAOCB
0955 0F 0F00  STAA  #PIAOCB
0956 0F 0F00  STAA  #PIAOCB
0957 0F 0F00  STAA  #PIAOCB
0958 0F 0F00  STAA  #PIAOCB
0959 0F 0F00  STAA  #PIAOCB
0960 0F 0F00  STAA  #PIAOCB
0961 0F 0F00  STAA  #PIAOCB
0962 0F 0F00  STAA  #PIAOCB
0963 0F 0F00  STAA  #PIAOCB
0964 0F 0F00  STAA  #PIAOCB
0965 0F 0F00  STAA  #PIAOCB
0966 0F 0F00  STAA  #PIAOCB
0967 0F 0F00  STAA  #PIAOCB
0968 0F 0F00  STAA  #PIAOCB
0969 0F 0F00  STAA  #PIAOCB
0970 0F 0F00  STAA  #PIAOCB
0971 0F 0F00  STAA  #PIAOCB
0972 0F 0F00  STAA  #PIAOCB
0973 0F 0F00  STAA  #PIAOCB
0974 0F 0F00  STAA  #PIAOCB
0975 0F 0F00  STAA  #PIAOCB
0976 0F 0F00  STAA  #PIAOCB
0977 0F 0F00  STAA  #PIAOCB
0978 0F 0F00  STAA  #PIAOCB
0979 0F 0F00  STAA  #PIAOCB
0980 0F 0F00  STAA  #PIAOCB
0981 0F 0F00  STAA  #PIAOCB
0982 0F 0F00  STAA  #PIAOCB
0983 0F 0F00  STAA  #PIAOCB
0984 0F 0F00  STAA  #PIAOCB
0985 0F 0F00  STAA  #PIAOCB
0986 0F 0F00  STAA  #PIAOCB
0987 0F 0F00  STAA  #PIAOCB
0988 0F 0F00  STAA  #PIAOCB
0989 0F 0F00  STAA  #PIAOCB
0990 0F 0F00  STAA  #PIAOCB
0991 0F 0F00  STAA  #PIAOCB
0992 0F 0F00  STAA  #PIAOCB
0993 0F 0F00  STAA  #PIAOCB
0994 0F 0F00  STAA  #PIAOCB
0995 0F 0F00  STAA  #PIAOCB
0996 0F 0F00  STAA  #PIAOCB
0997 0F 0F00  STAA  #PIAOCB
0998 0F 0F00  STAA  #PIAOCB
0999 0F 0F00  STAA  #PIAOCB
1000 0F 0F00  STAA  #PIAOCB

```

Listing 2. Initialization portion of the program (\$0850) where the program begins. This routine gives the operator the necessary prompts to insert the hours, seconds, minutes, etc. With the initialization complete, interrupts are enabled and the program waits for a "T" from the keyboard, at which time the time and date sentence is printed. This portion of the program may be removed.

used by the software clock routine. Thus, during a one-second period, the computer is called upon for 6 ms (.6 percent) to service the clock program. If you add an external hardware dividing circuit, such as a divide by 60 (i.e., Motorola MC14566) to give an interrupt only once a second, the 6 ms of overhead time will be reduced to 100 microseconds (.01 percent).

You can decide for yourself if the reduction in time is worth the extra effort of adding additional hardware. Bear in mind that the 100 microseconds of overhead time discussed above is an average. The worst case is approximately 400 microseconds, which occurs at the end of the year when all the variables roll over.

Software

The flowchart (Fig. 2) and the comments in the listings should be enough to give an explanation of the workings of the program. There are, however, a few points worthy of further clarification. When an interrupt occurs, the current status of the MPU is saved on the stack. The MPU then jumps to the location stored in location \$FFF8 and \$FFF9. In most systems using the 6800, this information is in nonvolatile memory. Therefore, the MPU is directed to another address in volatile memory, usually \$A000 and \$A001.

The second and third instructions in the program shown in Listing 2 show how \$A000 and \$A001 are initialized. In a system using multiple interrupts, the user will wish to alter this address to allow control to be transferred to an interrupt polling subroutine, which determines the origin of the interrupt.

As shown in Listing 1, the time and date sentence starts at location \$0822 and ends at \$083C. The last character is an asterisk (*), which is used as the end of transmission character. The subroutine COX prints the characters until it detects the asterisk and then returns. The number of spaces between the time and date, as well as the entire format of the sentence, may be altered, but this may require that the program be reas-

Listing 3. Heart of the software clock (see Fig. 2). Each time an interrupt occurs, the MPU is vectored to location START (\$0900). If 60 interrupts have not occurred, the MPU will immediately return from the interrupt. However, if 60 interrupts have been counted, execution will continue and the time and date will be updated as necessary. If a timebase other than 60 Hz is used, merely change the operand of the CMPA instruction at location \$0909.

```

0900 8A 8101      * START  LDAA  PTADB  CLEAR INTERRUPT FROM #1A
0903 7C 0800      INC  KTIME  ADD ONE TO INTERRUPT COUNTER
0906 8A 0800      LDAA  KTIME
0909 81 3C        CMPA  #60    WAIT FOR AN INTERRUPT
090B 27 01        BEQ   CLCK   IF 60 INTERRUPTS PASSED GO TO CLOCK PROGRAM
090D 38           RTI
090E 7F 0800      CLR  KTIME
0911 C6 30        LDAB  #30
0913 7C 0828      INC  USEC   ADD ONE TO UNIT SECONDS
0916 8A 0828      LDAA  USEC   LOAD ACC A WITH UNIT SECONDS
0919 88 3A        EORA  #3A
091B 27 01        BEQ   ITSEC  UNIT SECONDS OVERFLOW, GO INC T SECS
091D 38           RTI
091E 7C 0824      INC  TSEC   INCREMENT TENS OF SECONDS
0921 F7 0828      STAB  TSEC
0924 8A 0824      LDAA  TSEC
0927 88 36        EORA  #36
0929 27 01        BEQ   IUMIN  TENS OF SECONDS OVERFLOW, INC U MIN
092B 38           RTI
092C 7C 0828      INC  UMIN   INCREMENT UNIT MINUTES
092F F7 0824      STAB  TSEC
0932 8A 0828      LDAA  UMIN
0935 88 3A        EORA  #3A
0937 27 01        BEQ   ITHIN  UNITS MINUTES OVERFLOW, INC T MIN
0939 38           RTI
093A 7C 0827      INC  THIN   INCREMENT TENS OF MINUTES
093D F7 0824      STAB  UMIN
0940 8A 0827      LDAA  THIN
0943 88 36        EORA  #36
0945 27 01        BEQ   IUHRS  TENS OF MINUTES OVERFLOW, INC U HRS
0947 38           RTI
0948 7C 0828      INC  UHRS   INCREMENT UNIT HOURS
094B F7 0827      STAB  THIN
094E 8A 0828      LDAA  UHRS
0951 81 34        CMPA  #34
0953 27 0C        BEQ   ITHRS  UNIT HOURS OVERFLOW, INC T OF HRS
0955 81 3A        CMPA  #3A
0957 27 01        BEQ   ITHRS  INCREMENT TENS OF HOURS
0959 38           RTI
095A 7C 0824      INC  THRS   INCREMENT TENS OF HOURS
095D F7 0828      STAB  UHRS
0960 38           RTI
0961 8A 0824      LDAA  THRS
0964 81 32        CMPA  #32
0966 27 01        BEQ   IUDAY  TENS OF HOURS OVERFLOW, INC U DAY
0968 38           RTI
0969 7C 0835      INC  UDAY   INCREMENT UNIT OF DAYS
096C F7 0824      STAB  THRS
096F F7 0828      STAB  UHRS
0972 8A 0835      LDAA  UDAY
0975 81 0801      CMPA  UDAY1  LOAD ACC A WITH UNIT DAY
0978 27 0C        BEQ   ISIT3  DRES UNIT DAY INDICATE END OF MONTH
097A 81 3A        CMPA  #3A    BRANCH, UNITS OF DAY INDICATES END OF MONTH
097C 27 01        BEQ   ITDAY  TENS OF DAYS OVERFLOW
097E 38           RTI
097F 7C 0834      INC  TDAY   RESET UDAY TO 0
0982 F7 0835      STAB  UDAY
0985 38           RTI
0986 8A 0834      LDAA  TDAY
0989 81 0802      CMPA  TDAY1  LOAD ACC A WITH TDAY
098C 27 01        BEQ   NEWMB  DRES TEN OF DAY INDICATE END OF MONTH
098E 38           RTI
098F 7C 0832      INC  UMBN   RESET DAY TO THE BEGINNING OF MONTH
0992 F7 0835      STAB  UDAY
0995 7C 0835      INC  UDAY
0998 F7 0834      STAB  TDAY
099B 8A 0832      LDAA  UMBN   RESET DAY TO BEGINNING OF MONTH
099E 81 33        CMPA  #33
09A0 27 0C        BEQ   ISIT4  DRES UNITS OF MONTH INDICATE END OF YEAR
09A2 81 3A        CMPA  #3A
09A4 2A 06        BNE  CONT1  CONT1
09A6 7C 0831      INC  TMBN
09A9 F7 0832      STAB  UMBN
09AC AD 16        CONT1  BRR  MTEST  WHAT IS THE NUMBER OF DAYS IN NEW MONTH
09AE 38           RTI
09AF 8A 0831      LDAA  TMBN
09B2 81 31        CMPA  #31
09B4 2A 06        BNE  CONT1
09B6 7C 083A      INC  UYRS   INCREMENT UNIT OF YEARS
09B9 F7 0832      STAB  UMBN   RESET TO FIRST MONTH OF NEW YEAR
09BC 7C 0832      INC  UMBN
09BF F7 0831      STAB  TMBN   RESET TO FIRST MONTH OF NEW YEAR
09C2 20 EA        BRA  CONT1
09C4 8A 0831      LDAA  TMBN
09C7 F6 0832      LDAB  UMBN
09CA C4 0F        ANDB  #0F
09CC F7 0809      STAB  UMBN1  SET BITS 4,5,6, AND 7 TO ZERO
09CE 48           ASLA
09D0 48           ASLA
09D2 48           ASLA
09D3 8A 0809      LDAA  UMBN1
09D6 81 02        CMPA  #2
09D8 2A 02        BRA  APRIL  SET TA MONTH WITH 28 DAYS
09DA 20 21        BRA  #0
09DC 81 04        CMPA  #4
09DE 2A 02        BRA  JUNE   SET TA MONTH WITH 30 DAYS
09E0 20 26        BRA  #0
09E2 81 06        CMPA  #6
09E4 2A 02        BRA  SEPT   SET TA MONTH WITH 30 DAYS
09E6 20 20        BRA  #0
09E8 81 09        CMPA  #9
09EA 2A 02        BRA  NOV    SET TA MONTH WITH 30 DAYS
09EC 20 1A        BRA  #0
09EE 81 11        CMPA  #11
09F0 27 16        BEQ   #0

```



```

09F2 86 32
09F4 87 0801
09F7 86 33
09F9 87 0802
09FC 39
09FD 86 39
09FF 87 0801
0A02 86 32
0A04 87 0802
0A07 39

```

```

*
*
*
M031

```

```

LDAA #032
STAA UDAY1
LDAA #033
STAA TODAY1
RTS

```

IF THERE IS NO MATCH, IT MUST BE A MONTH
WITH 31 DAYS
MONTHS THAT HAVE 31 DAYS ARE
JAN, MARCH, MAY, JULY, AUG, OCT, DEC

FEBRUARY

MONTHS THAT HAVE 30 DAYS ARE
APRIL, JUNE, SEPT, NOV

```

0A08 86 31
0A0A 87 0801
0A0D 86 33
0A0F 87 0802
0A12 39
0A13

```

```

*
*
*
M030

```

```

LDAA #031
STAA UDAY1
LDAA #033
STAA TODAY1
RTS

```

END

sembled, depending on the nature of the change.

As previously stated, the interrupt frequency can be

changed to virtually any value. For example, if the 60 Hz time-

base is reduced to 15 Hz, simply change the operand value of the CMP A instruction at \$0909 from 60 (\$3C) to 15 (\$0F).

The program requires slightly over 1/2K of memory, and execution starts at \$0850. Reassembling the program at \$0000 would improve the efficiency, since the 6800 could then use direct addressing. This has an advantage since it would decrease the program's overhead time, as well as reduce the amount of memory required. ■

★ WP 6502 ★

word processing system for most 6502's

OSI C1 & C2 available now!

(Pet, Apple and OSI-C3 versions Jan 1)

OUTPERFORMS OSI's \$200 SYSTEM YET WP-6502 SELLS FOR ONLY \$75!

- Global editing with echo-checking and 200+ character insertion.
- Fully menu-driven. You'll read the manual only once!
- Cursor-controlled screen edit with unlimited insertions.
- Conforms to standard AP and Thesis style.
- All in assembler. Usable in machines from a 4K tape-based C1 to full disk systems. (all in one version)
- Keyboard not restricted by OSI's shift-lock right/left shift conventions. Just like a "real" keyboard.
- Use any printer and any I/O devices supported by your machine.
- WP-2 files easily converted to full-power WP-6502!

Send \$75 for same-day shipment (specify tape or disk 5" or 8") or send \$2 (refundable) for the full operations manual.



Dwo Quong Fok Lok Sow
371 Broome St.
NY, NY 10013 ✓ D67



T
O
R
A
S
Y
S
T
E
M
S
I
N
C.

Call about our fantastic price on 4-drive complete system.

Level II 4K	\$557.10
Level II 16K	\$750.00
(w/o num. keypad)	
Expansion Interface	\$269.00
Expansion Interface 16K	\$423.00
Expansion Interface 32K	\$524.00
16K Memory Kit for TRS-80 or Apple	\$89.95



TRS-80 & NORTH STAR ADD-ON DRIVES

CUSTOM ENCLOSURE

CABLE INCLUDED



Shugart SA 400 or BASF 6106 single drive system in custom enclosure \$415.00
Double drive system in custom enclosure \$825.00

BASF 6106 40 track, drive only	\$299.00
Shugart SA 400	\$315.00
Seamon 8" drive	\$399.00
HAZELTINE 1400, WHILE SUPPLY LASTS! (18 MONTH WARRANTY)	\$649.95
Centronics P1 printer (TRS-80 add-on)	\$396.95
Centronics 779-2 tractor (TRS-80 add-on)	\$1049.95
TI printer	\$1599.00
Horizon 1 Kit	\$1339.00
Single tier walnut Formica enclosure for SA 400 or BASF drive	\$27.00
Two tier walnut enclosure for SA 400 or BASF drive	\$45.50
Verbatim mini disks, 5-1/4", box of 10	\$3.20 per disk
Box of 10, 8" disks	\$0.95 per disk

★ ★ MAIL ORDER ONLY ★ ★

INTERTUBE TERMINAL
\$784.00



WE ACCEPT BANK AMERICARD, VISA, MASTER CHARGE

29-02 23RD AVENUE ASTORIA, NEW YORK 11105
(212) 728-5252

Soroc 120	\$790
Soroc 140	\$1260
Hazeltine 1400	\$685
Hazeltine 1410	\$780
Hazeltine 1500	\$999
Intertube	\$764
Perkins-Elmer/Bantan	\$775

TRS-80 Level II	
16K, exp. I/O	\$1199
32K, exp. I/O	\$1270

Sorcerer-Exidy	
16K system	\$1095
32K system	\$1270

24 HR. ORDER SERVICE
Ph (219) 293-4316 Mon-Sat

MID EAST MICRO

P.O. Box 621 ✓ M94
Bristol, IN 46507

Comprint 912	\$529
Heath WH-14	\$749
Centronics 779	\$995
Dec LA36	\$1345
Nec 5510	\$2455
Qume Sprints/45	\$2999
TI 810	\$1650

Cromemco	
ZPU(kit)	\$279
Z-2(kit)	\$545
Z-2D(kit)	\$1295
System 2	\$3399
System 3	\$4799
Multi-user basic	\$700

HANDLING: Terminals add 3% for shipping or freight collect
TO ORDER: Send certified check or M.O. For personal or business allow 2 weeks
INDIANA RESIDENTS: add 4%

SUPER SPECIAL Apple II 16K \$999.99



The Paper Tiger

\$950.00

With Graphics \$1090.00

**INTRODUCTORY
OFFER**

TEXAS INSTRUMENTS
TI 99/4

16K \$1099

16K RAMS for
APPLE II
TRS-80 **\$65**

VERBATIM
DISKS
10 for **\$27**

The Computer Stop
16919 Hawthorne Blvd.
Lawndale, CA 90260
(213) 371-4010

MON. - SAT.
10 - 6

✓ C147

**practical
applications**

BOOT- STRAP

TURN ON YOUR TRS-80 DISK SYSTEM AND GO RIGHT INTO YOUR BASIC PROGRAM—YOUR TRS-80 WILL LOAD AND RUN PROGRAMS—BY ITSELF! Yes, with this unbelievable program your computer will take command of itself whenever power-on or reset is pressed. Go from DOS all the way into your Basic program, execute DOS or Basic commands, load and execute any machine-language programs or subroutines you need (such as printer drivers, machine language sorts, etc.), set your file buffers and memory size, then run any Basic program you want, without lifting another finger! **BOOTSTRAP's** custom files make turn-key end-user applications simple! Requires disk system, works with DOS 2.1, 2.2 and NEWDOS, completely documented for easy implementation. **\$15.95**

PRACTICAL APPLICATIONS™ (415) 592-6633
1313 Laurel St., Suite 15, San Carlos, CA 94070

- ☐ Please send me TRS-80 BOOTSTRAP ✓ P76
(\$15.95 each enclosed. Calif. residents add tax).
☐ Send your catalogs.

Name _____

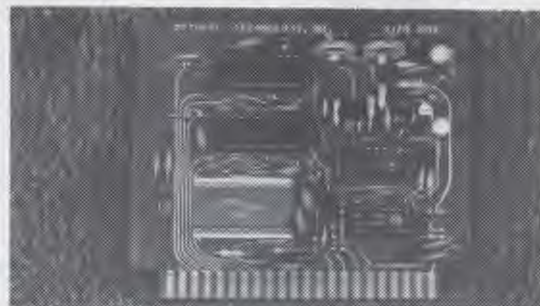
Address _____

City _____ State _____ Zip _____

TRS-80 is a trademark of Tandy Corp.

K-180

Analog I/O For Microcomputers



ANALOG I/O 802

The Analog I/O 802 card is a complete analog interface for your microcomputer. It consists of an 8 channel A/D and 2 channels of D/A. Interesting features include:

- Bipolar analog inputs and outputs ± 5 volts full scale.
- 500 conversions per sec (A/D), 2 micro-sec settling time (D/A).
- Low power, 50 mA typical from ± 12 volt supply.
- Requires only 2 I/O ports to interface to your microcomputer.
- On board voltage regulators.
- Supplied with connector, sockets for IC's.
- Ready to use when you receive it.
- 10 Meg input impedance (A/D), latched D/A converters.
- Packaged on 4.25"x3.75" PC card.
- 8 bit accuracy for A/D and D/A.
- Gold plated PC board contacts.
- Address decode for A/D.
- Assembled and tested, price \$115.00.

The ANALOG I/O 802 is easily interfaced to microcomputer I/O ports including: the 6820, 6520, 6530, 6522, 3850, 3851, 8755, 8212, etc.

Optimal Technology, Inc.

Blue Wood 127, Earlysville, VA 22936

Phone (804) 973-5482

✓ O10



**BASF
6106**

5.25" FLOPPY DISK DRIVE

- 40 Track, single or double density
- Smaller size. Fit 3, 6106 drives into the space of 2 SA 400 drives
- Requires less power, generates less heat
- Uses ball bearing friction-free head positioner
- Track to track access time: 12 MSEC.
- Uses industry standard interface and power plugs, and mounting points.

**ALL THE ABOVE FEATURES AND MORE FOR ONLY
\$299.00 ea.**

FOR MORE INFORMATION CONTACT:

OTTO ELECTRONICS

P.O. BOX 3066, PRINCETON, NJ 08540

✓ O9 or call 609-448-9165

MC, VISA, COD accepted. NJ residents add 5% sales tax. Shipping and insurance extra.

YOU MAY ALREADY OWN YOUR NEXT 1200 BAUD DECWRITER™

UPGRADE YOUR LA36 TO STATE-OF-THE-ART
PERFORMANCE WITH THE DS120 TERMINAL CONTROLLER



FASTER—The DS120 prints at up to 165 cps and maintains true 1200 baud throughput. This translates into lower costs in computer time as well as time savings for you. A 1000 character internal print buffer virtually eliminates the need for fill characters.

SMARTER—Our microprocessor control "intelligently" optimizes carriage movement by printing bidirectionally and automatically executing high speed tabs over any blank spaces in the text.

MORE VERSATILE—We offer more standard features than any 1200 baud teleprinter currently available. A complete list of forms control and formatting features are programmable from the keyboard or via the data stream. The DS120 is equipped with both an EIA RS232-C interface and a 20 mA Current Loop interface. The unit communicates using the 128 character ASCII set at baud rates from 110 to 4800. Full-duplex, half-duplex and echo-plex modes may be selected from the keyboard. The controller supports half-duplex transmission using both coded-character turn-around and reverse channel protocol.

EASY TO INSTALL, EASY TO USE—The DS120 replaces your LA36 logic card in a matter of minutes and is fully compatible with the existing electronics. A comprehensive Users Manual provides detailed instructions for installation and operation.

RELIABLE—Our performance and reliability have been field proven in over 2500 installations.

INEXPENSIVE — BUT NOT CHEAP—Although the DS120 is just about the lowest cost way to print at 1200 baud, we don't cut corners on quality. The DS120 is built for years of service using pretested, high reliability components from leading manufacturers. Each unit undergoes a 48 hour test cycle before shipment and carries a 90 day warranty on materials and workmanship.

AVAILABLE—We can deliver typically within 30 days after receiving your order. Our stocking distributors are conveniently located in major cities throughout the U.S. for even better delivery.

DATASOUTH COMPUTER CORPORATION ✓ D65

527-F Minnet Lane • Charlotte, North Carolina 28210 • 704/523-8500
Installation of the DS-120 will void any DEC warranty or service contract.

DECWARTER is a registered trademark of Digital Equipment Corporation.

TRS-80® BUSINESS SOFTWARE Why not buy THE GENUINE ARTICLE???

The Osborne & Associates applications (Payroll with Cost Accounting, Accounts Payable & Accounts Receivable, and General Ledger) are on their way to becoming the standard applications software in the microcomputer field.

The genuine O&A software is written in CBASIC® for the CP/M® Operating System. Any other combination of language and operating system represents a reprogramming effort... for the TRS-80, Model I, several organizations have done such a reprogramming in Disk BASIC under TRSDOS. These packages have certain drawbacks such as having some features of the application removed. In addition, the fact that they are written in a source interpreter BASIC causes the comments in the source programs (if these are distributed at all) to be removed in the interest of saving space and execution time. Since CBASIC is a compiled language, comments cost nothing (in either space or execution time) in the executable version of the file—but such comments are invaluable in the later program maintenance and modification that is always required on applications software. Without having such comments, it is easy to spend many times the cost of the software on just one modification/maintenance effort. A buyer should take this into consideration when looking at the apparent cost of the package. The CBASIC source programs we sell are heavily commented to aid the programmer.

Our programs are **THE GENUINE ARTICLE**... the CBASIC source code as developed by Osborne & Associates. We furnish the buyer BOTH the TRS-80, Model I version (requires a 48K Model I with two or more disks) AND the unmodified 8" version (for later use on the TRS-80, Model II or other 8" CP/M system)... at no extra charge. By using our DOWNLOAD program, it is possible to start using the applications on the Model I, and then when the Model II is up and running at a later date, download the data files from the Model I to the Model II and keep running the same applications without disrupting your operation.

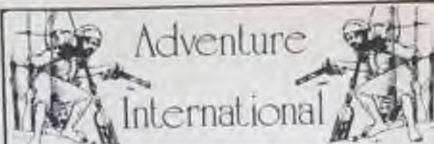
The Osborne & Associates books have been rewritten to reflect the CP/M, CBASIC versions of the applications. These books can be purchased either from your local computer store or from us directly. We can see no percentage in your buying other than **THE GENUINE ARTICLE**... which is what we sell... the Osborne & Associates source programs in CP/M and CBASIC.

CP/M Operating System	\$150.00
CBASIC Compiler	95.00
O&A Payroll w/Cost Accounting	250.00
O&A Accts. Rec./Accts. Payable	250.00
O&A General Ledger w/Cash Journal	250.00
O&A CBASIC books for above (each)	15.00
DOWNLOAD program	95.00

TRS-80 is a registered trademark of Radio Shack, a Tandy company.
CP/M is a registered trademark of Digital Research.
CBASIC is a registered trademark of Software Systems.

CYBERNETICS
N
C

8041 NEWMAN AVENUE • SUITE 208 • HUNTINGTON BEACH, CALIFORNIA 92647 • (714) 848-1922



"Highest rated games are the Adventure games".
Robert Parker Edition 7 CCR

Declared a true "Classic".

Computer Cassettes Review, Fall '79

"Adams' Adventure is exquisite. It is a true tour-de-force".

Recreational Computing Sep/Oct '79

Out of 50 programs reviewed Adventure was rated No. 11 "Highly Recommended".

80 Software Critique Issue No. 1

"I highly recommend these programs".

80-US Journal, Sept/Oct '79

Adventures by Scott Adams are available from our many fine Dealers for TRS-80, Pet, Sorcerer and by Christmas, the Apple III!

Write for free flyer — Each Adventure \$14.95

Adventure International ✓ A102

Box 3435

Longwood, Florida 32750

COD/Visa/Mastercharge — Call (305) 862-6917

TRS-80 COMPUTING

nonprofit newsletter

12 Issues For \$15.00

and now (US)

PEOPLE'S SOFTWARE

at popular prices

- Tape 1: 34 Level II or 24 Level I (Indicate which you want) business, home, educational, \$7.50
- Tape 2: 77 Level II from "Common Basic Programs" by Osborne Associates, \$7.50
- Tape 3: People's Pascal program development system, \$15
- Tape 4: 21 misc. Level I programs, \$7.50
- Tape 5: 24 misc. Level II programs, \$7.50
- Tape 6: People's Pascal II, \$23.00

Add 50¢ P&H each tape, CA residents add tax.

CIE COMPUTER
INFORMATION
EXCHANGE

✓ C104

Box 158 San Luis Rey, CA 92068

TRS-80 SOFTWARE

MONITOR #1.....\$39.95
Disassembler; ASCII and hex displays; memory move, search, verify, and modify; read and write object tapes; hex arithmetic; object code relocater; unload programs from TRSDOS memory areas to disk; symbolic tape.

MONITOR #4.....\$49.95
Add, save and read disk files; direct input and output of disk sectors; send, receive or talk to another computer via the RS-232-C interface; symbolic disassembly on disk.

PACK/UNPACK.....\$24.95
Increase disk file capacity by 33% with NO NEW HARDWARE. Applies only to string data. Ideal for mailing lists, telephone files, etc.

HOME BUDGET.....\$49.95
Keeps track of your checkbook, income, and monthly bills. Computes monthly and year-to-date summaries. (Requires 32K, disk.)

MAILING LIST.....\$69.95
Over 1000 names on a single diskette! Add, change, delete, find name, alphabetic or zip sort, print labels or master list. (Requires 32K, disk.)

HOWE SOFTWARE

14 Lexington Road ✓ H47
New City, NY 10956

Build your own microcomputer as you learn computer technology at home.

New from NRI! The First Interdisciplinary Home Study Course Ever Offered

As the microprocessor revolutionizes the computer world and microcomputers appear almost everywhere, NRI brings you a new, convenient, and effective way to keep up with this expanding technology. It's NRI's courses in Microcomputers and Microprocessors, created and designed exclusively for learning at home in your spare time.

Designed for the New Breed of Computer Technician

It's no longer enough to be just a programmer or technician. With microcomputers moving into the fabric of our lives as low-cost, easily available tools for business and home, both the programmer and technician must become total professionals. With practical knowledge of hardware, the programmer can design simpler, more effective programs. And with advanced programming skills, the technician can test and debug systems quickly and easily. The NRI course gives you simultaneous training in both skills...makes you one of this rare new breed.

Build Microcomputer, Test Instruments

NRI goes far beyond book learning to give you practical, "hands-on" experience. As you learn, you actually assemble NRI's designed-for-learning microcomputer. It performs like the finest of its kind, and features both assembly and basic language capabilities.

Every assembly step's a learning step. Using the NRI Discovery Lab® plus the NRI transistorized volt-ohm meter and CMOS digital frequency counter you also build, you perform meaningful experiments throughout your course...trace circuitry, interface components,



introduce and correct problems, design your own programs, and more.

The Proven Way to Learn at Home

You don't have to worry with travel, classes, or time lost from work when you learn the NRI way. As they have for more than 60 years of teaching technical subjects, NRI brings the material to you. You study in your spare time, at your convenience, using "bite-size" lessons that program material into logical segments for easier assimilation. You perform experiments and build equipment using kits we supply. And your personal NRI instructor is always available for consultation should you have questions or problems. Over a million students have already shown the effectiveness of NRI training.

Choice of Courses

Several courses are available, depending upon your needs and background. NRI's Master Course in Microcomputers and Microprocessors starts with the fundamentals, explores basic electronics and digital theory, the total computer world, and the microcomputer. The Advanced Course, for students already

versed in digital electronics, concentrates on software and the world of the microprocessor and microcomputer. In both courses, you build all instruments and your own computer.

Send for Free Catalog... No Salesman Will Call

Get the details on these exciting new courses in NRI's free, 100-page catalog. Shows all kits and equipment, lesson outlines, and full information, including facts on other electronics courses. Mail the coupon today and we'll rush your catalog. No salesman will ever call. Keep up with the latest technology as you learn on your own computer. If coupon has been removed, write to NRI Schools, Computer Department, 3939 Wisconsin Ave., Washington, D.C. 20016.



NRI Schools
McGraw-Hill Continuing
Education Center
3939 Wisconsin Avenue
Washington, D.C. 20016

NO SALESMAN WILL CALL.

Please check for one free catalog only.

- ☐ Computer Electronics Including Microcomputers
- ☐ TV/Audio/Video Systems Servicing
- ☐ Complete Communications Electronics with CB • FCC Licenses • Aircraft, Mobile, Marine Electronics
- ☐ CB Specialist Course
- ☐ Amateur Radio • Basic and Advanced



All career courses
approved under GI Bill.
☐ Check for details.

- ☐ Digital Electronics • Electronic Technology • Basic Electronics
- ☐ Small Engine Repair
- ☐ Electrical Appliance Servicing
- ☐ Automotive Mechanics
- ☐ Auto Air Conditioning
- ☐ Air Conditioning, Refrigeration, & Heating Including Solar Technology

Name _____ (Please Print) Age _____

Street _____

City/State/Zip _____

Accredited by the Accrediting Commission of the National Home Study Council

172-010

The PET® Gazette and PET User Notes are now a part of **COMPUTE.**

The Journal for Progressive Computing™

Continuing major sections on Business, Industrial and Educational Applications and Resources, Plus The PET® Gazette, The ATARI® Gazette, The APPLE® Gazette and The SBC (Single Board Computer) Gazette. All in each issue!

A Sampling of Our 104 page "Super" Fall Issue:

Tokens in Microsoft BASIC: Harvey Herman. ATARI Computers: The Ultimate Teaching Machines?: John Victor. Carl Moser Presents a Universal 6502 Memory Test. Microcomputers in Nuclear Instrumentation: Joe Byrd. AIM 65 Review: Don Clem. Mastering The Ohio Scientific Challenger 1P: A Learn-By-Doing Approach: Keith Russell and Dave Shultz. CORVUS 11A Disk Drive for APPLE: A Review by Michael Tulloch. Pierre Barrette on Microcomputers in Education. Len Lindsay Reviews Three Word Processors. PET in Transition/ROM Upgrade Map: Jim Butterfield. Trace for the PET: Brett Butler. 32K PET Programs Arrive: Len Lindsay. Using Direct Access Files With the Commodore 2040 Dual Disk Drive: Chuck Stuart, plus Reviews, Resources and Products.

New Features Coming in January include: "Rambling" by Roy O'Brien and "The Tape Exchange" by Gene Beals.

1980 Bimonthly Subscription (Six Issues) \$ 9.00
"Super" Fall Issue With 1980 Subscription 1.00
\$10.00

Make Check or Money Order Payable to **COMPUTE.**
Post Office Box 5119
Greensboro, North Carolina 27403 USA ✓C173

COMPUTE., the new
6502 resource magazine for
PET, Apple, Atari, Kim, Sym, Aim
and OSI Owners.

COMPUTE. The Journal for Progressive Computing is published by Small System Services, Inc. of Greensboro, North Carolina. Robert Lock, Editor/Publisher.

MACO MAGIC MODULE

89.95



89.95

TRS-80 USERS

Expand your TRS-80 without the need for an expensive expansion interface with these features:

- SELF-CONTAINED POWER SUPPLY
- AUDIO OUTPUT FOR MUSIC, MONITORING CASSETTE, AND SIGNALING
- REAL-TIME CLOCK DISPLAYED UPPER RIGHT SCREEN - HH:MM:SS
- TWO HAND CONTROLLERS
- SOFTWARE PACKAGE: COMPUT-A-SKETCH MICRO-DRAW
BULLYARD REAL-TIME CLOCK
- INSTRUCTIONS FOR USE WITH BASIC AND ASSEMBLY LANGUAGE

MACO Manufacturing
1383 Airways Boulevard
Memphis, TN 38114 ✓M124

ORDERING: MONEY ORDER OR CHECK - WE PAY FREIGHT
VISA, MASTER CHARGE, C.O.D. - FREIGHT WILL BE ADDED TO THE ORDER.
ON CHARGE CARDS INCLUDE ALL DATA ON CARDS AS WELL AS COMPLETE ADDRESS.

16K STATIC RAM



with
\$275 450 ns
\$300 250 ns
memory chips

Assembled, Tested and Guaranteed

Static TMS 4044 or equivalent - Fully Static 4Kx1 Memory Chips for full DMA capability, no tricky timing problems.

Fully S-100 Bus Compatible - All lines fully buffered, Dip Switch Addressable in two 8K block, 4K increments. Write Protectable in 2 blocks. Memory Disable using Phantom. Battery back up capability.

Bank Select - Using output port 40H (Cromemco software compatible)-addressable to 512KB of Ram for time share or Memory Overlap, also has alternate ports 80H, COH.

Guaranteed - Parts and labor for one year. You may return the undamaged board within 10 days for a full refund.

Orders - You may phone for Visa, MC, COD (\$4 handling charges for COD) orders. Personal checks must clear prior to shipping. Shipping-Stock to 72 hours normally. Will notify expected shipping date for delay beyond this. Illinois residents add 5% tax. Please include phone number with order.

✓5129

S.C. Digital

P.O. Box 906 Phone:
Aurora, IL 60507 (312) 897-7749

Radio Shack DEALER

COMPUTER CENTER

MICRO MANAGEMENT SYSTEMS



M95

Up To 15% Discount
on
TRS-80's

MICRO-COMPUTER SPECIALIST

LARRY OWENS
COMPUTER CENTER

MINIMALL-DOWNTOWN SHOPPING CENTER
115C Second Ave. S.W.
Cairo, Georgia 31728
912-377-7120

TRS-80



Your TRS-80 II 16K
is the life of the party with
PARTY PROGRAM

PARTY PROGRAM is the perfect
excuse to show off your computer.

PARTY PROGRAM offers your favorite
drinks, fun, graphics & a barrel
of laughs.

- An excellent Christmas Gift - or
"Anytime Gift" for the computer nut
in your world.

Only \$14.95 for cassette

For same day service call
(715) 234-2680

Use your Visa or Master Charge



NorthStar Synergistics

N29

Box 336 Route 4
Rice Lake, Wis. 54868

SIMUTEK PRESENTS

★ TRS-80 ★

GAMES.....
!!! WHOLESALE !!!

PACKAGE ONE

GRAPHIC TREK "2000" - This full graphics, real time game is full of fast, exciting action! Explosive photon torpedoes and phasers fill the screen! You must actually navigate the enterprise to dock with the alien space stations as well as to avoid klingon torpedoes! Has shields, galactic memory readout, damage reports, long range sensors, etc! Has 3 levels for beginning, average, or expert players! * **INVASION WARG** - Time: 3:00. Place Earth's Solar System Mission. As general of Earth's forces, your job is to stop the Warg invasion and destroy their outposts on Mars, Venus, Saturn, Neptune, etc! Earth's Forces: Androids - Space Fighters - Laser Cannon - Neutronic Blasters! Warg Forces: Robots - Saucers - Disintegrators - Proton Destroyers! Multi level game lets you advance to a more complicated game as you get better! * **STAR WARS** - Maneuver your space fighter deep into the nucleus of the Death Star! Drop your bomb, then escape via the only exit. This graphics game is really fun! May the Force be with you! * **SPACE TARGET** - Shoot at enemy ships with your missiles. If they eject in a parachute, capture them - or if you're cruel, destroy them! Full graphics, real time game! * **SAUCERS** - This fast action graphics game has a time limit! Can you be the commander to win the distinguished cross? Requires split second timing to win! Watch out!

PACKAGE TWO

CHECKERS 2.1 - Finally! A checkers program that will challenge everyone! Expert as well as amateur! Uses 3-ply tree search to find best possible move. Picks randomly between equal moves to assure you of never having identical games. * **POKER FACE** - The computer uses psychology as well as logic to try and beat you at poker. Cards are displayed using TRS-80's full graphics. Computer raises, calls, and sometimes even folds! Great practice for your Saturday night poker match! (Plays 5 card draw). * **PSYCHIC** - Tell the computer a little about yourself and he'll predict things about you, you won't believe! A real mind bender! Great amusement for parties. * **TANGLE MANIA** - Try and force your opponent into an immobile position. But watch out, they're doing the same to you! This graphics game is for 2 people and has been used to end stupid arguments. (And occasionally starts them!) * **WORD SCRAMBLE** - This game is for two or more people. One person inputs a word to the computer while the others look away. The computer scrambles the word, then keeps track of wrong guesses.

PACKAGE THREE

POETRY - This program lets you choose the subject as well as the mood of the poem you want. You give TRS-80 certain nouns or names, then the mood, and it does the rest! It has a 1000-word vocabulary of nouns, verbs, adjectives and adverbs! * **ELECTRIC ARTIST** - Manual drawing, erase, move as well as. Auto: draw, erase and move. Uses graphics bits not bytes. Saves drawing on tape or disk! * **GALACTIC BATTLE** - The Swineus enemy have long range phasers but cannot travel at warp speed! You can, but only have short range phasers! Can you outsmart the enemy without getting destroyed! Full graphics - real time! * **WORD MANIA** - Can you guess the computer's words using your human intuitive and logical abilities? You'll need to, to beat the computer! * **AIR COMMAND** - Battle the Kamikaze pilots. Requires split second timing. This is a FAST action arcade game.

PACKAGE FOUR

LIFE - This TRS-80 machine language program uses full graphics! Over 100 generations per minute make it truly animated! You make your starting pattern, the computer does the rest! Program can be stopped and changes made! Watch it grow! * **SPACE LANDER** - This full graphics simulator lets you pick what planet, asteroid or moon you wish to land on! Has 3 skill levels that make it fun for everyone. * **GREED II** - Multi-level game is fun and challenging! Beat the computer at this dice game using your knowledge of odds and luck! Computer keeps track of his winnings and yours. Quick fast action. This game is not easy! * **THE PHARAOH** - Rule the ancient city of Alexandria! Buy or sell land. Keep your people from revolting! Stop the rampaging rats. Requires a true political personality to become good! * **ROBOT HUNTER** - A group of renegade robots have escaped and are spotted in an old ghost town on Mars! Your job as "Robot Hunter" is to destroy the pirate machines before they kill any more settlers! Exciting! Challenging! Full graphics!

PACKAGE FIVE

SUPER HORSE RACE - Make your bets just like at the real racetrack! 8 horses race in this spectacular graphic display! Up to 8 people can play! Uses real odds but has that element of chance you see in real life! Keeps track of everyone's winnings and losses. This is one of the few computer simulations that can actually get a room of people cheering! * **MAZE MOUSE** - The mouse with a mind! The computer generates random mazes of whatever size you specify, then searches for a way out! The second time, he'll always go fastest route! A true display of artificial intelligence! Full graphics, mazes & mouse! * **AMOEBA KILLER** - You command a one man submarine that has been shrunk to the size of bacteria in this exciting graphic adventure! Injected into the president's bloodstream, your mission is to destroy the deadly amoeba infection ravaging his body! * **LOGIC** - This popular game is based on Mastermind but utilizes tactics that make it more exciting and challenging - has 2 levels of play to make it fun for everyone. * **SUBMARINER** - Shoot torpedoes at the enemy ships to get points. Fast action graphics, arcade type game is exciting and fun for everybody!

PACKAGE SIX

20 HOME FINANCIAL PROGRAMS - Figures amortization, annuities, depreciation rates, interest tables, earned interest on savings and much, much more. These programs will get used again and again. A must for the conscientious, inflation minded person.

PACKAGE SEVEN

BACKGAMMON 3.0 - 2 different skill levels make this game a challenge to average or advanced players. (Not recommended for beginners). Looks for best possible move to beat you! FANTASTIC GRAPHICS. Plays doubles and uses international rules. * **SPEED READING** - Increases your reading speed. Also checks for comprehension of material. Great for teenagers and adults to improve reading skills. * **PT 109** - Drop depth charges on moving subs. Lower depths get higher points in this fast action graphics game. * **YATZEE** - Play Yatzee with the Computer. This popular game is even more fun and challenging against a TRS-80! * **WALL STREET** - Can you turn your \$50,000 into a million dollars? That's the object of this game. Simulates an actual stock market!

NOT AVAILABLE AT RETAIL STORES ANYWHERE

INSTRUCTION BOOK WITH EACH PKG.

ONLY 12.95 EACH!!!!

ALL PROGRAMS GUARANTEED TO LOAD
CASSETTE PACKAGES REQUIRE 16K LEVEL II
PACKAGES ON DISKETTE (32K) \$5.00 EXTRA



Send check, Money Order or Bank Card #

TO: SIMUTEK, P.O. BOX 35298
TUCSON, ARIZONA 85740
(602) 882-3948

S121

PHONE ORDERS WELCOME!

PLEASE ADD \$2.50 POSTAGE & HANDLING PER ORDER
3 OR MORE PACKAGES GET 10% DISCOUNT

Converting a Bargain TV to a Video Monitor

The Lancaster method really works!

Stephen E. Bach
Rte. 2, Box 50 A-1
Scottsville VA 24590

It is common knowledge in the microcomputer world that television sets can be used for video monitors, and many of us are doing just that. I want to share my experience in converting a relatively inexpensive, 12-inch black and white television set to direct video entry.

I bought a Westport Model RP-205BN television on sale at Woolco for \$69. It is all solid state (except for the picture tube, of course), operates from 12 V dc as well as 110 V ac and has a power transformer that isolates the whole unit electrically from the ac line, considerably reducing chance of shock. There is also an earphone jack that can be used as the entry point for the video signal from your video board/generator.

Last, and very important, is that with the operating instructions comes a separate sheet containing the complete schematic diagram of the TV! This is an unusual addition for a consumer electronic item. It is a deal hard to beat for the price, especially in comparison with the \$149 monitors I see advertised in the catalogs.

The Conversion Details

My guide for making the conversion was Don Lancaster's *The Cheap Video Cookbook*. It just so happens that the video amplifier circuitry shown by Lancaster on page 149 of his book corresponds exactly to

the video amplifier circuitry in the RP-205BN, including component numbers (e.g., Q201, the video amplifier and R113). It is as if Lancaster was looking at the schematic of the RP-205BN when he wrote the book! For those of us who are not used to poking our way into TVs, it is reassuring to find such corresponding information to use as a guide.

The most important modification—lifting Q201's base lead from the printed circuit board—could hardly be easier. All the leads of the transistor are labeled on the top side of the PC board (the transistor itself is easily found because

soldering and simply cut Q201's base lead above the board; however, that would leave a short lead to which you could connect the miniature coaxial cable.)

Don Lancaster describes the general procedure well enough. I will concentrate on the specifics for this set. Connecting the coax (I used RG-174U) to the video detector output is especially easy on this set because there is a test point prong, TP12, so labeled both in Lancaster's book and on the TV's schematic and located right next to Q201!

This test point in the original set is connected directly to the

piece of coax.

Actually, instead of using the earphone jack for the video input, I installed an extra jack next to it toward the back of the set; it was easier to do that than to remove the wires and solder from the earphone jack. They are small themselves, and the space is a bit cramped. This completed the chief modification.

Lancaster recommends removing the 4.5 MHz sound trap of the TV to improve the video bandwidth and transient response. On this Westport TV, the 4.5 MHz trap is a series resonant circuit made up of C201 and L201. To disable the trap I cut with an X-acto knife the PC board foil connecting C201 and L201. Across that cut I connected a miniature SPST switch by which I can reinsert the sound trap if ever I want to use the set again as a TV. I mounted the switch on the bottom of the TV between a couple of the ventilation slots in the plastic case.

After all that, I have been able to observe only a slight difference in display quality between the two switch positions. You could probably do without the modification.

I am using the Xitex SCT-100 video board for my display. Its video output level is 1.5 V peak-to-peak. This is not quite enough to drive the TV's video amplifier, so I had to change this level to match that required by the video amplifier. This modification is simple with Lancaster's book as a guide (see p. 159 of *The Cheap Video Cookbook*). For a slightly longer treatment of the problem, see

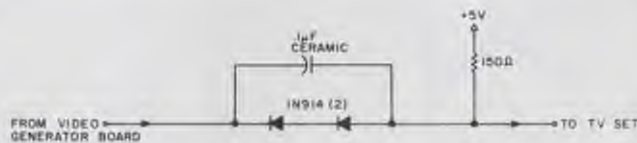


Fig. 1. Video output level modification.

most of the components on the board are clearly labeled). You don't have to do lots of detective work on pin-outs and let yourself be vulnerable to what I call Murphy's mix-ups.

I used some Solder-Wick to remove the solder from the printed circuit pad to which the base lead of Q201 was joined. I then gently pulled the lead out of its hole in the board with a pair of long-nose pliers, bending the lead slightly at the same time and pushing the transistor away from the hole also to ease the task. The most difficult part was over! (If you are nimble-fingered and have small hands, you can dispense with the de-

base lead of Q201. It couldn't have been more conveniently situated either in the circuit or on the PC board. It becomes for us the terminal of the TV's video detector output on the PC board. It was simple, then, to solder the center conductor of the coax going to the video detector output to this test point prong and the shield of the cable is to the nearby tin shield of the TV's I.F. section.

The other cable going to the ex-earphone jack is connected to Q201. The center conductor is soldered to the base lead of Q201, and the coax shield can be soldered to the same tin shield as was that of the other

Lancaster's *TV Typewriter Cookbook*, pp. 189-190).

I used two 1N914 silicon diodes in series as shown in Fig. 1. Two were enough. I mounted the diodes, capacitor and resistor close to the Xitex board in its enclosure. Finally, per Lancaster's recommendation (p. 150), I removed the lightning protection resistor (in this set it was 1 megohm) mounted near the antenna terminals.

Final Adjustments

On completing these modifications I hooked up the Xitex board to the TV via the new jack I installed and filled the screen with characters. The Xitex board generates 16 lines of 64 charac-

ters each. This number of characters pushes the screen's capacity to its limits. I found that the whole display was off center to the right and that the characters were not exactly vertical but leaning to the left slightly.

I went to the horizontal hold adjustment, a variable inductor next to the vertical hold on the back of the set. (I had the back of the TV off since the holes in the case were not well aligned with the adjustments' slots.) The horizontal hold adjustment requires a square tuning tool to fit the slug, which I did not have.

With a small piece of printed circuit fiberglass filed down to

size at one end, I adjusted the horizontal hold until the characters were all oriented straight up and down with no slant. This, however, shifted the whole body of characters over to the right so much that several columns were completely off the screen. I remedied this by moving one of the ring magnets on the CRT's neck (Don Lancaster shows them in Fig. 3-33, p. 152, and has a note about them on page 153). I moved the one whose tab is toward the white flyback transformer.

When I moved the tab initially, the other ring magnet moved with it; they were lightly stuck together. I held that one and

moved the first one. In this way, I was able to shift the whole body of characters back to the center of the screen. The vertical orientation of the characters was preserved. The display looks OK.

These easy-to-make changes and adjustments in a commonly available, inexpensive television set have given me a good quality video monitor for my microcomputer. I would encourage anyone beginning in microcomputing or anyone upgrading his or her system by adding a video display to do it in this way. I'll be happy to try to answer any questions you might have, but please include an SASE. ■

???###!!!!??#??!!###???

DISK DRIVE WOES? MEMORY LOSS? ?

ERRATIC OPERATION?

DON'T BLAME THE SOFTWARE!

*Power Line Surges & Hash could be the culprit!
Floppies, memory & processor often interact!
*Curb damaging Surges & Hash with our ISOLATORS and Suppressors/Filters. Eliminate Equipment Interaction with our unique ISOLATORS.

*ISOLATOR (ISO-1A) 3 filter isolated 3-prong sockets; integral surge suppression; 1875 W total load, 1 KW any socket.\$54.95

*ISOLATOR (ISO-2) 2 filter isolated 3-prong socket banks (6 sockets total); integral surge suppression; 1875 watt total load, 1 KW load either bank.\$54.95

*Suppressor/Filter (SFK-31) 3-prong socket; 1 KW load.\$24.50

*Suppressor/Filter (SFK-33) Three 3-prong sockets; 1250 watt load.\$32.50

PHONE ORDERS 1-617-655-1532

ESP Electronic Specialists, Inc.

171 South Main Street, Natick, Mass. 01760

Dept. KB

✓E36

✓VISA

?.?###!!!!??#??!!###???

16 K UPGRADE

\$69⁹⁵

TRS 80

APPLE

SORCERER

FACTORY PRIME 16 K RAMS FOR MEMORY UPGRADE. KIT INCLUDES FULL INSTRUCTIONS AND COMPONENTS TO ALLOW EASY 16 K CONVERSION IN 15 MINUTES. WHY PAY DOUBLE FOR THE SAME PARTS THE MANUFACTURER USES?

ADD \$2.00 POST AND PACKING; TEXAS RESIDENTS ADD 5% SALES TAX. CHECK OR MONEY ORDER ACCEPTED.

IAN ELECTRONICS

P. O. BOX 14079 ✓147

AUSTIN, TEXAS 78761

OSI SOFTWARE OSI

FOR

OHIO SCIENTIFIC

30 PROGRAMS

ALL ORIGINAL ALL IN BASIC ALL RUN IN 4K
ALL ON TAPE ALL WELL DOCUMENTED
AVAILABLE FOR C1, C2, AND SUPERBOARD

Our \$1.00 catalog includes a free game listing, programming hints, POKE locations, and other stuff OSI forgot to mention.

***** SPECIALS *****

CHESS FOR OSI \$19.95
(not in BASIC-specify system)

TEN TANK BLITZ \$9.95
A new concept in video board games for the wargamer who wants real time action.

LINE RENUMBERER \$4.95
Renumbers lines and GOSUBs, GOTOs, & IF THENs

✓A90 **AARDVARK**

TECHNICAL SERVICES

1690 BOLTON, WALLED LAKE
MI 48088 313-624-6316

FREE! up to \$170. in merchandise with purchase of PET-CBM item !!!

DATE MATCH

PET 16K Large Keyboard	\$ 995	\$130
PET 32K Large Keyboard	\$1295	\$170
PET 8K Large Keyboard (New)	\$ 795	\$100
PET 2040 Dual Disk (343K)	\$1295	\$170
PET 2023 Printer (gross load)	\$ 849	\$110
PET 2022 Printer (finc load)	\$ 995	\$130
KIM-1 \$159 (Add \$30 for Power Supply)	SYM-1	\$ 209.00
AXIOM EX-801 Printer-PET		\$ 477.00
2114 L 450 ns	5.35	24/4.95 100/4.45
2716 EPROM (5 Volt)		38.00
6550 RAM (for 8K Pet)		12.70
PET 4 Voice Music System (KL-4M)		29.50
All Books and Software		15% OFF
Loedel Video 100 12" Monitor		119.00
Anderson-Jacobson 841 Selectric (part)		1015.00
Heath WH-19 Terminal (fact. asm.)		770.00
Heath WH-14 Printer (fact. asm.)		735.00
Programmers Toolkit - PET ROM Utilities		44.90
Microchips 2.0 for PET or APPLE		17.90
PET Word Processor - Machine Language		24.00

3M Scotch 8 Disks 10/31.00
3M Scotch 5 Disks 10/31.50
Verbatim 5 Disks 10/26.50
Disk Storage Pages 10/ 3.95

Cassettes (all tapes guaranteed) Premium quality, high output low noise in 5 screw housing with labels. AGFA PE 611
C-10 10/5.95 50/23.00 100/48.00
C-30 10/7.00 50/30.00 100/57.00

Add \$1 per order for UPS shipping
Ask for 6502, TRS-80, and S-100 Product List.

A B Computers

115 E. Slump Road
Montgomeryville, PA 18936
(215) 699-8386

FORTH is an advanced language/ system for advanced programmers. MMSFORTH is a professional version tailored to the Radio Shack TRS-80 Model I.

microFORTH PRIMER (required) \$15.00
MMSFORTH System Diskette (1 drive & 16 K req.) \$64.95
or MMSFORTH System Cassette (Level 2, 16K) \$44.95

Shipping \$2. Mass. orders add 5% tax.

Interpreter and Compiler
Expandable Instruction Set
Structured Programming
Very Fast and Compact

mmsFORTH

MILLER MICROCOMPUTER SERVICES
67 Lake Shore Road, Natick MA 01760 (617) 653-6136
Send SASE for free information. ✓M114

MICRO — INNOVATIONS

6800 SOFTWARE IN BASIC

VERSATILE AND COMPACT TEXT PROCESSOR... \$10.00
Cassette oriented, speeds, justifies, line insertion-deletion correction, only 1uk machine needed.

LOAN AMORTIZATION SCHEDULE... \$10.00
Home mortgage or financed purchases, accuracy to the penny, beautifully formatted output.

LEASE-PURCHASE ANALYSIS... \$10.00
Handles different payment schedules, your choice of depreciation methods.

ANY OR ALL OF THE ABOVE ON ONE KCS CASSETTE... \$5.00
add

PROGRAM DOCUMENTATION INCLUDES:
Operating instructions with examples, cross-reference of variables & line numbers, all variables documented as to use, an extended listing with long and meaningful variables used in place of basic variables. ✓M12

DISK NI 33M3J105 0089

P.O. BOX 53 HURON, OHIO 44839

MAILROOM PLUS®

Make Your TRS 80 Work Like A Mini-IBM!

Mailroom Plus was developed for the National Rifle Association membership mailings. It features sorting by last name or member number in addition to zip code. The program will sort 500 names in 30-40 minutes, kill duplicates, and close up the file. Mailroom Plus will also search all records for category, name, state, zip (or any other search code) and print these records on labels or in tabular form. It separates large files into smaller ones by state or zip or merges small files into one large one. Mailroom Plus is available on 32-48K disk for \$75.00 by first class mail. Order yours today postpaid.

THE PERIPHERAL PEOPLE P52

PO Box 524, Mercer Island, WA 98040

Master Charge and VISA cards welcomed



STAND
ALONE

VIDEO TERMINAL

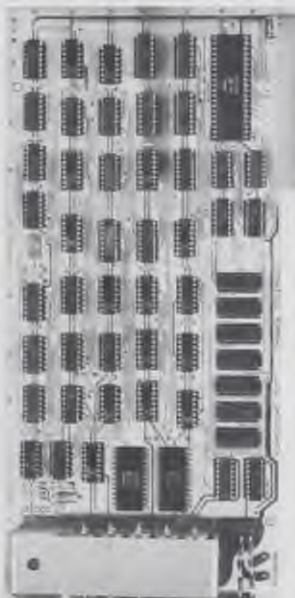
Now, a completely self-contained video terminal card for less than \$150.00. Requires only an ASCII Keyboard and TV set to become a complete interactive terminal for connection to your computer's serial I/O port. Two units available, common features are: single 5V supply, crystal controlled sync and baud rates (to 9600 baud), computer and keyboard operation, cursor control, parity error and control, power on initialization, forward space, line feed, see, line feeds, return, return cursor, and clear to end of line. Power requirements are 5V at 800mA, output video TV and video and serial TTL level data.

Features:	TH3216	TH6416
Display	32 characters by 16 lines 2 pages	64 characters by 16 lines scrolling
Characters	Upper case ASCII	Upper/lower case optional
Baud Rates	300-9600	110-9600
Controls	Read to/from memory	Scroll up or down
Price (kit)	\$149.95	\$189.95

Above prices include all IC sockets

OPTIONS:

Power supply (mounts on board)	\$14.95
Video/RF Modulator, VD-1	6.95
Lower case option (TH6416 only)	14.95
Assembled, tested units, add	60.00



GVBERNEN

"TH-6416 shown above"

Frequency Counter \$89.95 KIT

You've requested it, and now it's here! The CT-50 Frequency Counter Kit has more features than counters selling for twice the price. Measuring frequency is as easy as pushing a button. The CT-50 will automatically place the decimal point in all modes, giving you quick, reliable readings. Want to use the CT-50 module? No problem, it runs equally as well on 12 VDC as it does on 110 VAC. Want super accuracy? The CT-50 uses the popular TV color burst freq of 3.5745 MHz for time base. Tap off a color TV with our adapter and get ultra accuracy—0.01 ppm! The CT-50 offers professional quality at the unheard of price of \$89.95. Order yours today!



SPECIFICATIONS

Sensitivity: less than 20mV
Frequency range: 0Hz to 60MHz, typically 60MHz
Gate time: 1 second, 1/10 second, with automatic (normal) power processing on both direct and precise
Display: 8 digit red LED w/ margin
Accuracy: 2 ppm, 600 ppm with TV time base
Input: 500k, 1 meg ohm direct 30 ohm with parallel resistor
Power: 110 VAC 5 watts or 12 VDC 4.9 amp
Size: Approx 6" x 4" x 2" high quality aluminum case

PRICES

CT-50, 60 MHz Counter Kit	\$89.95
CT-50WT, 60 MHz counter, wired and tested	\$159.95
CT-600, 600 MHz prescaler option for CT-50, add	\$29.95

VIDEO TO RF MODULATOR

Convert any TV set to a video monitor. Super stable output is glitch free, variable open channels 4-6. Runs on 5-15V. Recommended by many computer manufacturers. Std. Video input. Complete kit, VD-1 \$6.95

LINEAR REGS TRANSISTORS

555 .50	309K .99	NPN 2N3904 type	10/\$1.00
556 .75	340K-12 .99	PNP 2N3906 type	10/\$1.00
566 1.49	7805 .99	NPN Power Tab 40W	3/\$1.00
567 1.49	7812 .99	PNP Power Tab 40W	3/\$1.00
324 1.49	7815 .99	FET MPF-102 type	3/\$2.00
1458 .49	78MKG 1.50	UJT 2N2646 type	3/\$2.00
380 1.49	723 .49	2N3055 NPN Power	75

IC SOCKETS	8 pin	14 pin	16 pin	40 pin	14 pin
RS232C/TTL	5/\$1.00	5/\$1.00	5/\$1.00	5/\$1.00	5/\$1.00
TTL/RS232	5/\$1.00	5/\$1.00	5/\$1.00	5/\$1.00	5/\$1.00
Converter kit	5/\$1.00	5/\$1.00	5/\$1.00	5/\$1.00	5/\$1.00
Complete kit	\$7.95	\$7.95	\$7.95	\$7.95	\$7.95

ramsey electronics

Box 4072K ROCHESTER NY 14610 (716) 271-5487

Satisfaction guaranteed or money refunded. Orders under \$10 add 7.5% CDS add \$5.00. NY add 7.5% sales tax. Please orders welcome. Minimum order \$5.00.

MINI-KITS

FM WIRELESS MIKE KIT
Transmit up to 300' to any FM radio. Sensitive microphone requires dynamic, crystal or ceramic mike. Runs on 3 to 9 volts.
FM-1 \$2.95

LED Blinky Kit
A great attention getter which automatically flashes 2 colors LEDs. Use for name badges, buttons or warning type panel lights.
Complete Kit, BL-1 \$2.95

LED Blinky Kit
A great attention getter which automatically flashes 2 colors LEDs. Use for name badges, buttons or warning type panel lights.
Complete Kit, BL-1 \$2.95

LED Blinky Kit
A great attention getter which automatically flashes 2 colors LEDs. Use for name badges, buttons or warning type panel lights.
Complete Kit, BL-1 \$2.95

LED Blinky Kit
A great attention getter which automatically flashes 2 colors LEDs. Use for name badges, buttons or warning type panel lights.
Complete Kit, BL-1 \$2.95

LED Blinky Kit
A great attention getter which automatically flashes 2 colors LEDs. Use for name badges, buttons or warning type panel lights.
Complete Kit, BL-1 \$2.95

LED Blinky Kit
A great attention getter which automatically flashes 2 colors LEDs. Use for name badges, buttons or warning type panel lights.
Complete Kit, BL-1 \$2.95

A.C. POWER CONTROL for ALL COMPUTERS or COMPLETE TURNKEY SYSTEMS



Interface TO the Real World with GIMIX Relay Driver Boards. Connects to any Computer through a 20 ma. current loop (up to 4 Boards-128 Relays per port).

Interface FROM the Real World with GIMIX

★ OPTO BOARDS (up to 34 switch closures with one 8 bit Parallel I/O Port)

★ 16 BUTTON KEYPADS

★ 35 BUTTON ALPHANUMERIC KEYPADS

A Broad Range of 6800 Systems and Boards Compatible with the SS50 Bus



MAINFRAME: Includes chassis, power supply, switches, fan and mother board... \$ 798.19

16K SYSTEMS: Mainframe, plus 6800 CPU, 16K Static Ram and choice of I/O... \$1344.29
Other packages available.

**16K Static RAM
Boards for the
SS-50 Bus**

- Gold bus connectors
- 4 separate 4K Blocks
- Individual Addressing, Write Protect, and Enable/Disable for each block



\$298¹³

All GIMIX memory boards are assembled, Burnt-In for 2 weeks, and tested at 2 MHz. Add \$32.00 for 250 ns parts

TI TMS 4044's — 10% SUPPLY
(Not an "equivalent", but the real thing!)

450 ns	\$5.90 each	250 ns	\$6.90 each
8K PROM BOARD			\$ 98.34
4K PPD PROM BOARD, Burner and Duplicator			198.35
2708's		each	7.90
64 or 32 x 16 VIDEO BOARD			198.71
80 x 24 SUPER VIDEO BOARD with user programmable RAM character generator			458.76
Serial I/O's	1 Port	\$ 88.41	4 Port 198.43
Parallel I/O's	2 Port	\$ 88.42	8 Port 198.45

Add \$5. handling charge on orders under \$200.

GIMIX inc.

1337 WEST 37th PLACE CHICAGO, ILLINOIS 60609
(312) 927-5510 • TWX 910-221-4055

Quality Electronic products since 1975.

TRS-80, Apple II
and S-100 owners.

Busy Box.™

It makes your
computer
do things
it never
did before.



MicroMint introduces a new wireless AC remote control interface for the Sears and BSR X-10 home control system. Use your present TRS-80 Level II, Apple II or S-100 computer to provide complete home security through control of lights, appliances and motors with a few simple Basic commands. Buss compatible with virtually all microcomputers. **Completely assembled** — Just plug in and turn on!

BUSY BOX™



Assembled and tested.

Busy Box	\$79.95
Cable and connector for TRS-80	14.95
Cable and adapter for Apple II	29.95
Cable and adapter for S-100	34.95
Power Supply (necessary for TRS-80)	9.95

Introductory Special:

Complete Busy Box System	
For TRS-80 including cable and power supply	99.95
For Apple II including cable and adapter	104.95

NY residents add 7% sales tax.

To order call (516) 374-6793

or write: The MicroMint Inc.
917 Midway
Woodmere, NY 11598

Dealer inquiries invited.

TRS-80 is trademark of Tandy Corp.
Apple II is trademark of Apple Computer



MICROCOMPUTER SOFTWARE

(Floppy and hard disk systems)

- Medical Systems for Doctors
- Word Processing for Attorneys
- Membership for Churches
- Inventory for Auto Dealers
- Client Accounting for CPA's
- Listings for Realtors
- Fund Raising for Agencies
- Financial Systems for all Companies

If you are planning or developing business and accounting applications in the above areas for sale in the national marketplace, our company will review and evaluate your software to determine its suitability to the small business environment. We will arrange marketing channels for your firm, and establish acceptable royalty provisions for all of your products sold to our customers. If interested in further information about our National Microcomputer Software Marketing Plan, send a list of your applications with sample report and screen layouts, and hardware specifications to:

Software Review Staff



Microtel, Inc.

✓ M108

P.O. Box 1098
Gastonia, North Carolina 28052
704-866-7157

FORT//80™

FORTTRAN

for the 8080 only **\$99.95**

- FORT//80 is a subset of Fortran IV with many powerful enhancements!
- FORT//80 is an advanced software development tool!
- FORT//80 is AFFORDABLE!!

✓ R8

FEATURES

- FORT//80 directly addresses 8080 ports as FORTRAN variables
- I/O drivers accessed via FORTRAN read/write statements
- FORT//80 accepts embedded in-line machine code
- 8080 condition codes are available as FORTRAN keywords and can be operated upon
- Multiple assignment operators accepted
- Interleaved listings and object code for quick debugging
- Symbolic names up to 31 char long simplify documentation
- Constants expressible to base 2, 8, 10, 16 or as char strings
- Compact; Needs only 25K for compiler and minimum workspace
- Fast; Runs up to 10 times as fast as PLM
- FORT//80 directives specify location of code in memory at run-time
- Interrupt and interrupt control
- FORT//80 control of interrupts and interrupt service lines
- All code runs on 8080, 8085 and Z80 (upward compatibility)
- FORT//80 is a true resident compiler and generates directly executable object code. No run time package needed
- FORT//80 is very fast. It compiles quickly and produces dense highly optimized code
- Single and double precision IBM format floating point arithmetic

PRICING

FORT//80 CPM version and manual on 8" diskette	\$99.95
FORT//80 Language manual separately	20.00
FORT//80 Implementation manual	20.00
Sample diskette validation program and data	5.00

Shipping charges to US and Canada postpaid, overseas add \$5.00. Please add appropriate state sales tax. Master Charge and Visa accepted.

1. FORT//80 is supplied on a single use basis, subject to the signing of a non-disclosure agreement.
2. FORT//80 can be implemented with other disc operating systems using the implementation manual or special versions available by quotation.
3. The purchase price of manuals and sample programs will be credited towards subsequent purchase of FORT//80.

ramsay electronics

BOX 4072, ROCHESTER, NY 14610
PHONE ORDERS CALL 716-271-6487

Distributors:

- Digital Research of Texas, Box 401565, Garland, TX 75040, (214) 271-2461
 - Electrolabs Inc., Box 6721, Stanford, CA 94305, (415) 321-5601
 - Arkansas Systems Inc., 8901 Kanis Rd., Little Rock, KS 72205, (501) 227-8471
 - Arkon Electronics Ltd., 409 Queen St. W., Toronto, ONT M5V 2A5, (416) 868-1315
- Dealer inquiries invited.

© Arkon Electronics Ltd.

Load Your SWTP at 4800 + Baud

The author tried JPC Products' cassette interface and found it reliable to 9600 baud.

Jerry L. Hunt
6709 Forsythia
Springfield VA 22150

While your Kansas City Standard tape is loading, do you:

- A. Tap your fingers impatiently?
- B. Yell at your kids and dog?
- C. Rebuild your keyboard?
- D. Take a correspondence course in brain surgery?

If you would like to spend less time fussin' and fumin' and more time computin', read on.

Since I've had a computer, I've spent several man-days waiting for my KC tapes to load. This has become limiting, as well as irritating. After becoming fed up, I started looking for a

medium with a bit more speed. My search first took me to the obvious devices such as digital tape decks and floppy disks. These gadgets have two common characteristics: quickness and expense. The first characteristic is very attractive, but the second is not as appealing.

One evening, while waiting for a tape to load and browsing through a *Microcomputing* magazine, I noticed an ad from JPC Products Co., PO Box 5615, Albuquerque NM 87185, for a \$49.95, 4800 baud tape interface bit that plugged into an SWTP I/O port. I looked at the remaining 10 minutes of KC tape still to be loaded and ordered the interface!

About three weeks (and

several more hours of KC tape loading) later, the package was delivered. It consisted of the hardware and a comprehensive hardware/software manual. The kit went together with ease. Hookup was equally easy and consisted of soldering two shielded cables to the connector and plugging them into a suitable cassette device.

Building Up Speed

Due to the high speed of the data flow—up to 9600 baud—two factors are important. High-quality tape is essential, as is a high-quality cassette machine. The manufacturer recommends only top of the line, low-noise tapes and provides a recommendation list of cassette recorders and decks. Basically, a good stereo tape deck and tapes should be used.

My way of providing these was to remove the stereo tape deck and tapes from my component stereo system. The deck has two features that are useful in this application: an accurate tape counter and vu meters (output meters). Also helpful were the record level and output level controls.

The software documentation provided included two programs: one for high-speed read and write and one for KC read. This type of interface is versatile as well as fast, since it functions almost entirely through software. Thus, it can be programmed for nearly any format,

current or future! The data transfer rate is controlled by software constants and the computer's clock. A short program is included to determine your SWTP computer's clock rate, and constants are furnished so that the baud rate is variable up to 9600!

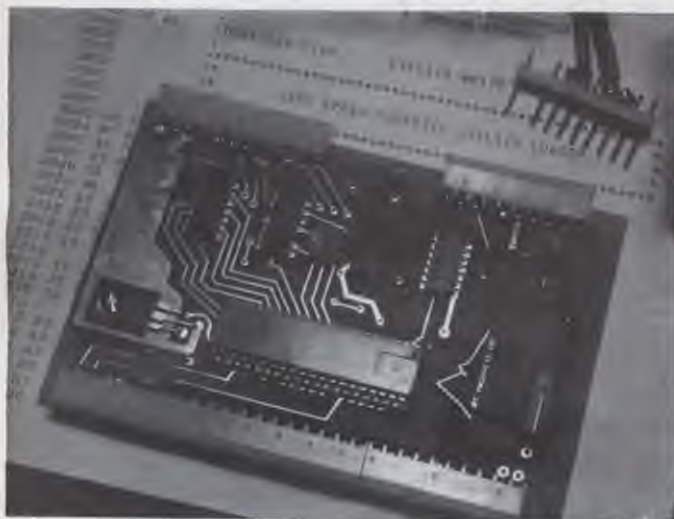
The manufacturer recommends the baud rate be set at 2400 for system setup, and once any bugs are exterminated, the rate is set to the advertised 4800 baud. After all the time I had sat listening to the whirring of my cassette recorder, this sounded like the speed of light! However, I also believed if 4800 was good, 9600 would be great!

I inserted the proper constants for 9600 baud in the program and, much to my amazement, it worked! JPC Products only guaranteed 4800 baud, but mine has been playing great at 9600.

About one out of 20 loads requires reloading, due to a slipped byte somewhere, but when the system indicates a good load, I never find an error. This system is much more reliable than my KC system.

The one factor I found somewhat uninspiring was the necessity to boot in the read software via our crawling friend, a KC tape. It takes only about 30 seconds to load; however, I was spoiled.

My SWTP system incorporates an MPA2 board, which will accommodate 8K of EPROM,



TC-3 Hi-Speed Cassette Interface.

017	ED. AS.	032	0000 FFFF	0100
Counter Start	Program Name	Counter End	Beginning Address Ending Address	Program Entry Address

Example 1.

and since the high-speed software is relocatable, I burned a 2716 with it. Loading 8K now takes only typing JC002 and waiting only 12 seconds! It takes only about 16 seconds at 4800 baud, probably due to software overhead time, which is not affected by the changeable constants.

File Search Program

I now had a system almost as fast as a disk, except for the file search capabilities. I work around this with a written listing, the footage counter and the output meters. My listing for a program is shown in Example 1.

I first set the memory locations MA002 through MA005,

with the beginning and ending addresses I wish the program loaded into. You can put the program anywhere, unlike KC Standard tapes.

Next, I fast-forward or rewind the tape to one count prior to the start point (16 for this program). I then type JC002, press play on the deck and monitor the output meters for data output. At completion of a good load, the system returns directly to monitor control. If there is an error in the byte count read versus the byte count set in A002-5, a register dump will print prior to return to monitor. Total time from system start-up to operation in 8K is about 40 seconds. Writing to tape is done in the

same manner with the write program.

I also have the KC loader in ROM, but I seldom use it since I have left the AC-30 and recorder on-line to load commercially purchased BASIC tapes. I'm hoping the company will give us some software to patch their operating system into popular BASICs. If that happens, would anyone like a good deal on an AC-30 and a very tired cassette recorder?

I'm currently working up software that will allow me to type in addresses more conveniently, use one-letter commands for control and allow one-letter load-run commands.

As I mentioned earlier, good tapes are essential. I have been using Radio-Shack-certified data tapes with excellent success. I have also used top-of-the-line, high-quality tapes from various manufacturers with good success, but anything less doesn't work! I like the Radio Shack tapes also for their 20 minute length. That's about

300K bytes including inter-program spaces! An additional feature of the interface (frosting on the cake) is a fully buffered 8 bit parallel output port.

Conclusion

I am immensely pleased with this system. I recommend it without reservation as the best buy in town for fast, economical off-line storage. My system cost me only \$49.95 for the interface. If you need a good tape deck, add about \$80 to that. So for less than \$150 you can have a 4800 baud system capable of storing one megabyte (60-minute tape).

I have no association with JPC Products, except for admiring their product. I haven't even communicated with them, since the interface and software operate flawlessly.

I have also just discovered that JPC is offering software for a cassette operating system, file handling and basic patches. My prayer is answered for about \$27 on cassette! ■

WEB ASSOCIATES

EXCLUSIVE TO TRS-80™ USERS

TSHORT™ — THE GREATEST SOFTWARE BUY OF THE YEAR! HAVE YOU BOUGHT YOURS YET?



SHORTHAND for LEVEL II and DISK BASIC

- * TSHORT™ lets you type LEVEL II and/or DISK BASIC more quickly and accurately than ever before. Save up to 90% programming time and achieve 100% accuracy.
- * 31 preprogrammed statement keys.
- * KUSTOM™ key, up to 64 characters — changeable anytime.
- * 42 key decals (see picture). 10 are different for DISK users.
- * A single, shifted-key entry types entire statement on screen.
- * Fast, efficient machine language.
- * Uses 580 bytes of LOW memory. i.e.: No MEM SIZE req'd.
- * Comes on cassette, one side LEVEL II, the other for DOS.
- * Compatible with DOS 2.1, 2.2, 2.3, NEWDOS, KBFIX, etc.
- * DOS version loads to and executes from disk via TAPEDISK.
- * Features self-entering commands: CONT; GOTO10; KUSTOM (Self-enter optional)
- * TSHORT W/4 page instruction manual \$9.95

OTHER PRODUCTS AND SERVICES:

- TBEEP™ For LEVEL II and DISK USERS — A self-contained beeper. Alerts you with a pager-like tone when YOUR program commands it! Simply plug in-line with the "AUX" cable from your CPU and program in BASIC, i.e.: OUT 255, 1: FOR I = 1 to 300: NEXT: OUT 255, 0. (Req's 9V Batt.) \$19.95
- TBUFF™ — For LEVEL II CASSETTE USERS. Prevent and eliminate forever, cassette relay sticking. TBUFF is no larger than an ice cube and plugs in-line with the "REMOte" cable to your cassette recorder. (Specify cassette recorder make and model) \$ 9.98
- TPAK™ — C-10 blank tape cassettes. AGFA 611 high quality tape — the best money can buy! We use this tape exclusively for TSHORT. Pack of 10 with box and blank labels. . . . \$12.95

COMING SOON: (Write for further details.)

- TBASE™ — A powerful DATA BASE MANAGER program second to none! for under \$50.00
- TCHAIN™ — LEVEL II chaining utility — Preserve your variables and arrays for multiple program use, or while EDITing, RUNing or CLOADing Priced under \$ 10.00
- TSEL™ — We'll convert your IBM SELECTRIC to a high quality printer — µp control — 512 character buffer — special TRS-80 cable with control switches — complete and ready to LPRINT (cleaning, minor service included) Priced under \$800.00

DEALER INQUIRIES INVITED
Send check or money order to:

TELEPHONE ORDERS: (714) 559-6249

W20

SORRY,
NO C.O.D.'S



WEB ASSOCIATES • P.O. BOX 60-KG • MONROVIA, CA 91016

(Calif. residents add 6% tax)

VERBATIM® ATHANA® BASF®
Floppy Diskettes for
ANY COMPUTER SYSTEM

8" Floppies only \$3²⁰

10 for \$3.65 ea. • 50 for \$3.40 ea.

We reserve the right to ship either of the name brands that we carry.

5 1/4 Mini-floppies only \$2⁶⁰

10 for \$3.10 ea. • 50 for \$2.85 ea.

SPECIFY SIZE, TYPE, & COMPUTER

5 1/4" Soft Sector, 10 Sector, 16 Sector—8" IBM Compatible, Soft Sector

CALL TOLL-FREE 24 HRS. TO ORDER

800-824-7888
OPERATOR 814

CALIFORNIA 800-852-7777



or C.O.D.

DC SOFTWARE & COMPUTER PRODUCTS

POST OFFICE BOX 503

SAN BRUNO, CALIF. 94066

FOR INFORMATION 415-348-2387

Compro

C159

Business Software for TRS-80

48k 2 drive system

Inventory Control—
 1000 items/disk, full reports **\$299**

Mailing List/Phone Directory—
 1000 listings/disk, instant recall,
 machine language sort, prints labels **\$179**

Business Mailing List—
 1500 listings/disk, multi-key search **\$199**

32k 2 drive system

General Ledger—
 200 accts., 1750 transact., full reports **\$159**

Accounts Payable—
 200 accts., invoice linked, full reports **\$159**

Accounts Receivable—
 200 accts., invoice linked, full reports **\$159**

Payroll—
 Computes all deductions, prints
 checks, statements, W-2, 941-A **\$249**

32k 1 drive system

Word Processor—
 full feature editing, unlimited formatting **\$179**

Appointment Calendar—
 Great for the Executive, prints calendar **\$99**

Also Available—Full Series of Real Estate Software
 write for details

Check or Money Order C.O.D. Orders—10% down
 User Manuals \$20/refund, w. purchase • Data Sheets \$.50 with SASE
 California Residents add 6% Sales Tax.

P.O. Box 1222
 Imperial Beach, CA 92032 (714) 429-9123

SOFTWARE
FOR THE TRS-80*



NOW!
A LIGHT PEN
FOR THE TRS-80
AND
SOFTWARE
THAT USES IT!

QS LIGHT PEN. We have taken the excellent PhotoPoint light pen and packaged it with our own custom software. You get the light pen, which plugs into your tape recorder, and an instruction booklet that includes the software you need to interface a light pen to your own BASIC programs. Our software routines are in BASIC and a simple GOSUB puts the light pen in action. Two program examples are included. The "menu select" mode lets you set up selection squares anywhere you wish on the screen. The "screen location" mode searches for the pen position and returns the screen address to the calling program. One 9V battery required, not included. Light Pen — \$19.95

SKETCH-80™ by Bob Christiansen. Use the QS light pen to draw figures on the TRS-80 screen. Figures are drawn at three times normal size. Then save your sketch in memory and start another one. Your sketch can be displayed at normal size or at the enlarged size at which they were drawn. Combine two or more sketches on the same screen. Save your sketches to tape or disk. You can even ask the computer to print out the POKE values required to produce your sketch. This system program figures out how much memory your TRS-80 has and allocates storage accordingly. Requires level II, 16K. On cassette — \$14.95

THE FOLLOWING PROGRAMS REQUIRE LEVEL II, 16K, AND CAN BE PLAYED WITH OR WITHOUT A LIGHT PEN.

POKER PETE™ by Dave Gubser. Play five card draw poker one-on-one against an animated PETE. Watch PETE shuffle and deal the cards. He will challenge you with bluffs, raises, calls and folds in this winner-take-all showdown. And watch out — PETE's got a gun! Three levels of skill. Written in BASIC. On cassette — \$11.95



LOWBALL POKER by Danny Shea. How low can you go? It's you against Micro Molly and the lowest hand wins. That's the rule in lowball poker. This version plays the popular Gardenia, California rules. Don't take her for granted — Molly plays an excellent game. Written in BASIC. On cassette — \$11.95

RUMMY MASTER by Dave Gubser. Play rummy against the computer. Exceptional graphics display your hand, the discards, and the cards that have been melded. You see your opponent shuffle and deal out the cards. Tested in an arcade, this program was a big hit. Written in BASIC. On cassette — \$11.95

MATCH CARDS by Danny Shea; **BANKSHOT** by Bob Christiansen. Two programs on one cassette. **MATCH CARDS** is a concentration-type game where you match numbers, letters, or graphic shapes. For 1 or 2 players. Automatic scoring rates your recall ability. Written in BASIC. **BANKSHOT** is a billiard-like game for those who think they know all the angles. Hit the ball into the pocket, but you must hit a wall first. Written in BASIC with machine language subroutines. Just CLOAD and RUN. For 1 or 2 players. On cassette — \$9.95

THE FOLLOWING PROGRAMS REQUIRE LEVEL II, 16K, AND DO NOT USE A LIGHT PEN.

FASTGAMMON™ by Bob Christiansen. Our popular machine language backgammon game that started us in business. The computer plays against you and makes good moves instantaneously. Option to replay dice rolls from the previous game. An eight-page instruction booklet is included. On cassette — \$19.95
 On diskette — \$24.95

DEBUG by Bob Pierce. Debug machine language programs by stepping through one Z-80 instruction at a time. Relocatable. Several display options. Multiple break points. Modify memory and registers. On cassette — \$14.95

Z-80 DISASSEMBLER by Vic Tolomei. Decode machine language programs, including TRS-80 ROM with this Z-80 Disassembler written in BASIC. Instruction mode prints out machine code and Zilog mnemonics in standard format. Or use the ASCII mode which converts machine language code to ASCII. On cassette — \$14.95



QUALITY SOFTWARE

6660 Reseda Blvd., Suite 103, Reseda, CA 91335
 Telephone 24 hours, seven days a week. (213) 344-6599

Q12

HOW TO ORDER: MasterCard and Visa cardholders may telephone their orders and we will deduct \$1 from orders over \$19 to compensate for phone charges. Or mail your order to the address above. California residents add 6% sales tax. Orders outside North America add \$5 for registered airmail, pay in U.S. currency.

*"TRS-80" is a registered trademark of Tandy Corp.

See and Copy Tape Data



use TRCopy WITH YOUR LEVEL II TRS-80*

TRCopy is a cassette tape copying system that lets you SEE what your computer is reading.

COPY ANY CASSETTE TAPE**

With the TRCopy system you can copy any TRS-80 Level II cassette tape whether it is coded in Basic or in machine language. You can also copy data created by programs and you can copy assembler listings.

YOU CAN SEE THE DATA

As the tape is being loaded, you can SEE the actual data byte-for-byte from the beginning to the end of the program. Up to 320 bytes are displayed at one time. ASCII characters are displayed on the first line and hexadecimal code is displayed on the following two lines. Data is displayed exactly as it is input including memory locations and check sums.

IDENTIFY PROGRAMS

With TRCopy you can identify programs on one-tape tapes without written documentation because you can SEE the filename. If you forget to label a tape, you can use TRCopy to display the tape contents and identify the cassette.

VERIFY CASSETTE TAPES

With TRCopy you can verify both the original tape and the tape copies. You can make certain that your machine reads the original tape correctly and that it makes byte-for-byte copies. TRCopy also counts as it reads giving you the exact length of the data.

MAKE BACKUPS FOR YOUR PROGRAMS

Now you can make backup copies of your valuable programs. Many times a cassette that you make will load better than one that is mass produced. The original can then be kept as a backup in case the copy is damaged.

MAKE COPIES OF YOUR SOFTWARE

If you are in the software business you can use TRCopy to make tested copies of your programs for sales distribution. TRCopy produces machine language tapes that are more efficient than those produced by the assembler itself.

RECOVER FAULTY DATA

With TRCopy you can experiment with the volume and level controls and you can SEE what the computer is reading—even if your computer will not read the data through normal read instructions! In this way it is possible to read and copy faulty tapes by adjusting the volume control until you SEE that the data is input properly.

SIMPLE - FASCINATING - FUN

TRCopy is not only a practical utility program, it is also a fascinating graphics program that lets you SEE, for the first time, cassette data as your computer is reading it. And it's as simple as 1-2-3. Just load, verify and copy. You will now be able to use cassette tapes with confidence knowing that TRCopy is there when you need it.

The TRCopy system is a machine language program with documentation explaining tape loaders, sync bytes, check sums and other formatting conventions. With the TRCopy system, you can SEE what you are doing!

TRCopy System including
Cassette Tape and Documentation

39.95
POST
PAID

Orders accompanied by money order or cashier's check mailed same day.
Orders paid by other check shipped in 14 days. No COD's. Return within 10 days for a full refund if you are not satisfied.

N.D. Orders Add 3% Sales Tax. *TRS-80 is a trademark of the Tandy Corporation. **You cannot copy the TRCopy cassette.

ORDER FROM

Data/Print

DEPT. KB, BOX 903, FARGO, N.D. 58107

CALL IN
YOUR
ORDER
Now!

—Call Toll-Free 24 Hours—
If you have a MasterCard or a Visa credit card, you can call toll-free from the nearest telephone and have your TRCopy system on its way to you today.
Call 1-800-437-4144 anytime - 24 hours a day.
For calls from N.D., Hawaii or Alaska call collect 1-701-237-0216



NOW USE TRCOPY WITH YOUR PRINTER

Included at no extra cost - Now you can use the TRCopy system to output tape data to a line printer or a quick printer. The data is printed exactly as it is input from the tape including file names, memory locations and check sums. A printed copy can be especially helpful in the analysis or recovery of records contained in tape data files.

✓ D50

ORDER YOUR TRCOPY SYSTEM NOW!

TOLL FREE
24
Hours
SAME DAY
SHIPMENT



the **ULTIMATE** in
CHEAP VIDEO

BOOK & KIT
ONLY \$42.95

Don Lancaster's "Cheap Video" concept allows almost unlimited options, including:

- * Scrolling - Full performance cursor.
- * Line/Character formats of 16/32, 24/80, 32/64 ... or almost anything.
- * Graphics - up to 256 X 256 B&W; 96 X 128 COLOR (requires low-cost option modules)
- * Works with 6502, 6800 and other micros.

SPECIAL OFFER: Buy the Kit (upper case alphanumeric option included) & get the Book at 1/2 price.

P9 **FINA** ELECTRONICS, DEPT. K, 1020 W. WILSHIRE BLVD., OKLAHOMA CITY, OK 73116

I'm Sold, PLEASE RUSH..... () SEND FREE CATALOG

() TVT-65g Kit & Cheap Video Cookbook - \$42.95

() TVT-65g Kit only (book required for assembly) - \$39.95

name: _____

address: _____

city: _____ state: _____ zip: _____

FINA ELECTRONICS, DEPT. K, 1020 W. WILSHIRE BLVD., OKLAHOMA CITY, OK 73116



Designed for your
TRS-80

VISA



The **Photopoint** Light Pen
T.M.

"a whole new concept in computer applications"

- All you have to do is **Point to Play!**
- 6 programs included—3 on tape.
- Complete Info sheet on how to write your own programs.
- Plugs directly into your TRS-80 system (Level II)
- Works with DOS too!
- Voids no Radio Shack warranties!!
- Over 500 sold...

Imagine, direct interaction with the video display. Now you can eliminate the often confusing keyboard from your real time programs.

Order Your Photopoint Today

Micro Matrix
P.O. Box 938
Pacifica, CA 94044

✓ M105

The only light pen approved by:
Quality Software/Instant Soft/Softside Mfg.

Only
\$19.95
complete
CA res. add 6% tax

The compatible 8" TRS-80™ Floppy Disk

Maxi-Disk™

MAXI-DISK™ — FIRST FULL-SIZED FLOPPY DISK FOR THE TRS-80

- Runs TRS-DOS on 8" drives
- Runs Standard CP/M™ *
- Over three times the storage of Mini-Disk
- Compatible with TRS-80 Mini-Disk, mix and match on same cable
- Over a Megabyte on-line with four drives
- Easy plug-in installation, soldering, trace cutting, or extra wires
- Uses your expansion interface
- Styled to co-ordinate with your existing system
- Only \$995.

* With Shuffleboard option



SINGLE DRIVE,
INTERFACE AND
TRS-DOS PATCH ... \$995
ADDITIONAL
DRIVES \$845



We're #1! We've produced more TRS-80 8" floppy disk systems than any other manufacturer.

Shuffleboard™

THE SHUFFLEBOARD™

The Shuffleboard allows you to run STANDARD CP/M. It's the perfect compliment for your MAXI-DISK. Plugs right into your Z-80 socket and releases the lower 16K of memory for use as RAM.

Now and only now can you run STANDARD CP/M in the TRS-80.

An on-board bootstrap phantom ROM allows you to instantly boot-up CP/M from your MAXI-DISK at will.

Shuffleboard and CP/M (on 8" diskette) with complete documentation \$249

MAXI-DISK SPECIFICATIONS:

Drive type: Siemens FD 100-8
Capacity: 290 Kilobytes
Transfer rate: 250 kilobits/sec.
Latency (avg): 83 ms
Access track to track: 6 ms
Head load time: 25 ms
Rotational speed: 360 rpm/Tracks: 77
Encoding method: FM
Size: 9 1/4" high x 18" deep x 4 3/4" wide
Cabinet color: gray

Send your check or money order to Parasitic Engineering, Box 6314, Albany, CA 94706. Or call BAC/VISA and MC orders to (415) 527-6133, 10 A.M. to 4:30 P.M. PST.

The number one name in creative hardware design

PARASITIC ENGINEERING

TRS-80 is a trademark of Radio Shack and the Tandy Corp. CP/M is a trademark of Digital Research. SHUFFLEBOARD & MAXI-DISK are trademarks of PARASITIC ENGINEERING.

✓ P63

DR. DALEY presents Software for the PET and the APPLE

Dr. Daley's software is proud to announce the release of a package of our best selling programs.

These programs, regularly retailing for over \$400, have been assembled into a single

package for only \$49.95. Included is our best selling TREK3, CHECKBOOK, and a mailing list, tutorials, games and puzzles for every member of the family. All attractively packaged in an album.

50 PROGRAMS ONLY \$49.95*

*After January 1, 1980 the price will be \$69.95. Disk version \$10 extra.

Your order will be shipped within four business days from receipt.

Charge your order to
MC/VISA



DR. DALEY, 425 Grove Avenue, Berrien Springs, Michigan 49103

✓ D43

Phone (616) 471-5514 Sun. thru Thurs., noon to 9 p.m. eastern time.

CLASSIFIEDS

Classified advertisements are intended for use by persons desiring to buy, sell or trade used computer equipment. No commercial ads are accepted.

Two sizes of ads are available. The \$5 box allows up to 5 lines of about 35 characters per line, including spaces and punctuation. The \$10 box allows up to 10 lines. Minimize use of capital letters to save space. No special layouts allowed. Payment is required in advance with ad copy. We cannot bill or accept credit.

Advertising text and payment must reach us 60 days in advance of publication (i.e., copy for March issue, mailed in February, must be here by Jan. 1). The publisher reserves the right to refuse questionable or inapplicable advertisements. Mail copy with payment to: **Classifieds, Kilobaud Microcomputing, Peterborough NH 03458.** Do not include any other material with your ad as it may be delayed.

\$\$\$-WANTED—TRS-80s—WANTED—
 \$\$\$ Any quantity, any condition, immediate cash available. Used TRS-80s and peripherals available. Write for firm cash offer. Also used DEC PDP8, 11 CPUs, peripherals. Jim Simpson, Box 632, W. Caldwell NJ 07006. Tel. eves. (201) 226-9185.

Dual N. Star mini-floppies with controller, cables and \$700 accounts-receivable and gen'l ledger software—\$1000. Termini 300B KSR RS-232 30 cps, \$700. Integrand mainframe, fully socketed, \$275. Cromemco A/R, A/P, G/L, Payroll & Inventory, \$350 ea. J. Kelly, 400 W. Madison St., LaGrange KY 40031. (502) 222-0465 evenings.

CIP, Superboard II Owners. Complete, accurate, professional circuit diagram of 600 board; 17" x 22" print; \$5. Circuit diagram for TTY interface; \$2. Pete Hitt, Box 266, La Luz NM 88337.

TRS-80 computers used in evening adult class. Several memory sizes, disks, Centronics 779 printers, latest modifications. Some software. Jerry Scott, 717 Villa, Watonga OK (405) 623-5805.

For Sale: RCA VIP micro with 4K RAM, sound board, rf modulator, p.s., games and utility programs on tapes. Cost \$377; asking \$225. Call (617) 481-8543 in PM.

OSI C-1P w/20K RAM & 610 bd. Includes floppy intfc. & KC std. tape intfc. 3 I/O ports. Like new. \$695. L. Gabrielson, 1038 4th St., Rensselaer NY 12144.

For Sale: Diablo Hytype I. Superb condition, includes full documentation, power supply, stand, tractor and driving electronics—\$1500. Also Xybek "Prammer" 1702 programmer. Has 256 bytes of RAM and sockets for 7 1702s (4 incl. with programmer). Instruction manual and software on EPROM is included—\$75. R. C. Akeson, 12714 West Hampton Ave., Butler WI 53007. (414) 781-8820, days.

Going out of business—must sell. OSI Chal III, dual flop, 32K OS65U Act IVB Micro-term CRT, all in excel condition, no reas offer refused. Software—utility, games, word proc. Taylor Dist Co., 7530 E. Kenyon Ave., Denver CO 80237. (303) 779-1632. Sell separately or together.

For Sale: Interact Model I computer, joysticks, 15 games, Level I & II BASIC, manuals, extra documentation; \$400 (new). Edgar Cormier, 1427-3 Rustic, Ocean NJ 07712.

Apple/ALF music users interested in trading songs contact Gary M. LaPoten, 333 North Palm Drive, Beverly Hills CA 90210.

For Sale: ASR-33 TTY with paper tape reader/punch, modem, stand. \$500, you pick up. All back issues of Byte; \$2.50 each. National Multiplex tape cartridge system 3M3A for S-100, \$175. Lenny Heath, 6618-D Lake Hill Dr., Raleigh NC 27609. (919) 876-4168.

TEI Business Computer—48K—with dual drive 8" floppy, CPM operating system. Professional machine. Costs \$8995, will sell for \$4995. Call (816) 531-1050 for details.

For Sale: Heathkit ETW-3400 microprocessor trainer plus EE3401 program instruction plus parts. \$330 value for only \$250 or best offer. Great for beginners or children. John Hansen, 314A Millett St., Wahiawa HI 96786. (808) 624-9690 or (808) 655-9721.

Heath H8, 8K RAM, ser I/O, keyboard, video interface up and running. \$600. Charles Rapp, Jr., Rte 1, Box 51A, Minooka IL 60447. (815) 467-5786.

Must Sell Immediately! Ex cond. IBM Selecterm MDC mod 9710, 3 mo. No reas offer refused. (303) 779-1632. Taylor Dist Co., 7530 E. Kenyon Ave., Denver CO 80237.

For Sale: Imsai MIO board with mods to make it work, 2 parallel ports, serial port, Tarbell cassette port, software drivers, serial port untested, 2 Imsai 4K RAM boards, 1 Godbout 8K Econoram board, 62 key ASCII keyboard in dress enclosure. Make offer on any or all. Ray Turner, 14407 Broadgreen, Houston TX 77079. (713) 497-5849.

Free! TV Typewriter w/keyboard when you buy my SWTP 6800 computer system w/12K memory, AC-30 cassette interface, 4K + 8K BASIC for only \$550. Chris, (305) 259-4328.

Elf II, Giant, 4K, pwr, rf mod, BASIC, Pittman, RCA, Osborne. Best offer. L. G., 334 Riverside, Palm Beach Gardens FL 33410. (305) 622-6655.

Peripheral Dynamics 1555HT card reader. Unused—reads 150 cards/minute. With manual, only \$400. (603) 485-9131. Mike Vitale, 135 Main St., Suncook NH 03275.

Printer, 110 cps, 132 columns, 5 x 7 matrix, up to 6 copies, adj. tractors, self test; like new, just rebuilt by factory. This is a super printer. With RS-232 interface, only \$850. PT factory assy. S-100 bus 8K RAM, \$85. IBM 3740 compatible floppy-disk controller for use with Shugart, Siemens, Perlec or like drives; controls one to four drives. With manual containing S-100 and 6800 interface instructions. Cost \$850, only \$250. H. H. Hayden, POB 1275, Socorro NM 87801.

For Sale: PET 8K Model 2001; built-in cassette, calculator keyboard. Mint condition! 6 mos. old, hardly used! With dust cover, some programs. Asking \$575. Howard Bruff, 34 Elk St., Hempstead NY 11550. (516) 489-6746 after 5.

For Sale: Back issue set of Kilobaud, includes #1-#15, #20-#27, #30-#34, must sell as set; original Mark 8 minicomputer with 4K RAM, in quality cabinet, with Seolbi software, schematics, will send photo; basis microprocessor course. Best offer on any item. John Boyd, 6611 Burkett St., Houston TX 77021. (713) 747-3977.

For Sale: OSI CIP 8K. Includes extended monitor, editor/assembler and chess tapes. Moving to C4P. \$399 or best offer. Good condition. Barry Beal, RFD #1 Box 160, Machias ME 04654.

CORRECTIONS

The property gain/loss program associated with "Boy, Did I Make a Killing!" (November 1979, p. 112) has three small omissions. There are obvious blank spaces in lines 1340, 1450 and 1460. My smart printer should have put a "less than" sign in 1340 and an up arrow (raise to the power of) in 1450 and 1460.—Frank J. Derfler, Jr.

The - 12 volt rail in Fig. 1 of "An Inexpensive and Easy EPROM Board" (December 1979, p. 62) should be a - 5 volt rail.

In my article, "The Apple Goes to Market" (November 1979, pp. 70-76), there is an error in line 5110, Listing 5. In order to properly update the array, line 5110 should read:

5110 FOR I = Y TO X STEP -1: A(I) = A(I - 1): NEXT X = X - 1: A(X) = B

In the article, X and Y were transposed, causing improper decrementing of the array. Sorry for any inconvenience this may have caused. Thanks to George Culberson, W7CBU, who called from Utah to point this out.—Leslie R. Schmeltz.

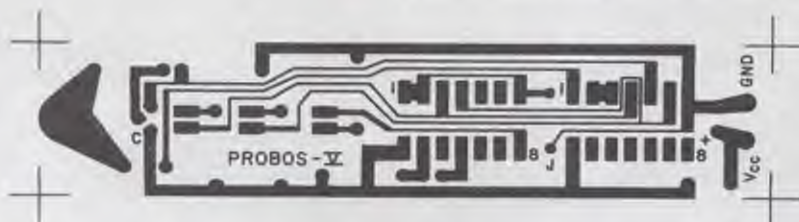


Fig. 3 of "Probos V."

Fig. 2 of "Probos V" (October 1979, p. 78) should show pin 3 of IC2 connected to pin 3 of IC1, and pin 6 of IC2 connected to pin 4 of IC1. It doesn't matter if the logic probe is built directly from the published schematic, but the corrected version will match up more closely to the printed circuit pattern. In addition, the anode of LED 3 (pulse indicator) should be shown connected to pin 8 of IC1. Fig. 3 also contains an error; see the corrected figure here.

The address of Statewide Mortgage Corp. (November 1979, p. 8) should be PO Box 660, El Cerrito CA 94530.

The following changes should be made to the "Inventory" program in the September 1979 issue. Also, the Sort subroutine changes should be made to the version that uses the machine-language sort routine.

DEALER DIRECTORY

Hollywood CA

Largest selection of computer books in the country. Software for the TRS-80, Apple, PET, etc. Magazines. Open Monday-Saturday, 9:30-5:30. **Opamp Technical Books, 1033 N. Sycamore Ave., Los Angeles CA 90038, 464-4322.**

Los Angeles CA

Featuring: PolyMorphic, North Star, Imsai, Cromemco, Extensys, Speechlab products and Poly-88 Users Group software exchange. All products 10-20% off list. We won't be undersold! **A-A-A Discount Computer How's, 1477 Barrington, Suite 17, Los Angeles CA 90025, 477-8478.**

Mountain View CA

Systems for business, industry and hobbyist. Five terminals, ten printers and five mainframes on display. Superbrain, Horizon Quad, Compucolor II, Equibox and Altos Computer System with hard disk. Much software incl. CP/M, TRS-80 and PET. **Digital Deli Computer Store, 80 W. El Camino Real, Mt. View CA 94040, 961-2670.**

San Francisco CA

Apple Specialists in business, personal and custom applications. Full line of peripherals, supplies and for leisure; sophisticated electronic games and video games. **A.I.D.S., Inc., Artificial Intelligence Design Specialists, Inc., 301 Balboa St., San Francisco CA, 221-8500.**

Pompano Beach FL

Business systems, personal systems, whatever the application, we can help. Consulting, programming, education and maintenance. Service, support and professionalism at affordable prices. **Computer Age Inc., 1308 N. Federal Hwy., Pompano Beach FL 33062, 946-4999.**

Venice FL

Discount prices & professional service. Cromemco, Northstar, Vector Graphic, DEC, TI, Thinker Toys, Intertube, Soroc, Centronics, NEC, Selectric interfaces, Microdasy. Complete business & medical billing software available. **MicroAge & Serendipity software discounted. Sara-Tech Electronics, Inc., Computer Division, PO Box 692, Venice FL 33595, 485-3559.**

Aurora IL

Microcomputer systems for home or business; peripherals, software, books & magazines. Apple, North Star, Cromemco systems. Also TI 910 and the ID5-440 printer w/Apple graphics. **Farnsworth Computer Center, 1891 N. Farnsworth Ave., Aurora IL 60505, 851-3888.**

Chicago IL

Computer Hardware/Software Specialists for home and business. Largest selection of computer books, magazines and copyrighted software in Chicago Metro area. Experienced factory-trained service department. Feature Apple and Alpha Microsystems and accessories. **Data Domain of Schaumburg, 1612 E. Algonquin Road., Schaumburg IL 60195, 397-8700.**

Naperville IL

Computer systems design, programming and consultation by computer experts. Dealer for IBM, Integrand, Tarbell, Ithaca Intersystems, Verbatim, Diablo and others. Discount prices on many items. **Wilcox Enterprises, 25W178-39th St., Naperville IL 60540, 420-8601.**

Laurel MD

Exidy Sorcerer & accessories, Vista floppy-disk systems, memory boards, software & books, full line of ham & SWL equipment. **The Comm Center, Laurel Plaza, Rte. 198, Laurel MD 20810, 792-0600.**

Worcester MA

Computer products for personal and business systems. Largest selection of software for TRS-80, Apple, PET. Authorized Apple sales and service. **Computer Packages Unlimited, Centerwood Terrace, Route 12, West Boylston MA 01583, 835-3428.**

Garden City MI

Complete systems for business, professional and personal applications. Custom programming available. Apple II, North Star, Vector Graphic and other lines of microcomputers, software, books, components. **Computer Center, 28251 Ford Rd., Garden City MI 48135, 422-2570.**

Dealers: Listings are \$15 per month in prepaid quarterly payments, or one yearly payment of \$150, also prepaid. Ads include 25 words describing your products and services plus your company name, address and phone. (No area codes or merchandise prices, please.) Call Marcia at 603-924-7138 or write **Kilobaud MICROCOMPUTING**, Ad Department, Peterborough NH 03458.

Here's what the Data Domain of Schaumburg IL says about the Dealer Directory: "Yes! We want to continue with the Dealer Directory ad. The response this past year has been good. We have had many people calling and visiting the store because they have seen that ad. It is very cost effective, too!"

Grand Rapids MI

Full-line microcomputer store. Ohio Scientific—Equinox—PolyMorphic Systems—Digital Systems—Godbout—Dynabyte—Thinker Toys—Meca—North Star. **Micro Computer World, 313 Michigan St., N.E., Grand Rapids MI 49503, 451-8972.**

St. Louis MO

Experimenters' Paradise. Electronic and mechanical components. Computer People, Audio People, Hams, Robot Builders, Experimenters. Open six days a week. **Gateway Electronics Corp., 8123-25 Page Blvd., St. Louis MO 63130, 427-6116.**

Lynbrook NY

Complete line of business computer hardware, software & service. Design of special software to suit your business. Specialists in systems for truck routing & restaurants. **Long Island Computer General Store, Inc., 103 Atlantic Ave., Lynbrook NY 11563, 887-1500.**

New York NY

Ohio Scientific distributor. Full stock, service and software. Software for PET, Apple, TRS-80 and hobbyist accessories (Jim Pak). **Aristo-Craft Computers, 314 Fifth Ave., Corner 32nd St., New York NY 10001, 349-9034.**

Akron OH

We've got it all. Business systems, Personal systems. Software packages. Custom programming. Terminals. Printers. Service and books. Easy freeway access. 10 AM to 6 PM Monday-Saturday. **The Basic Computer Shop, Fairlawn Plaza, 2671 West Market St., Akron OH 44313, 867-0808.**

Canton OH

Cromemco, Ohio Scientific, Centronics printers. Hazeltine terminals (CRT) Two-dimensional plotter software for Cromemco, as well as three-dimensional plotter software for Cromemco. Business software. Mon.-Sat. 10-7. **The Micro-Shop, 5686 Dressler Rd., North Canton OH 44720, 497-0847.**

Kingston PA

We support Level II and Model II. Books, magazines, programs, parts, accessories, peripherals, free literature, free seminars, cassettes, floppies, filters, transformers, caps, chips. **Artco Electronics, 302 Wyoming Ave., Kingston PA 18704, 287-1014.**

Philadelphia/So. Jersey

Intertube II, immediate delivery. Free video terminal comparison. Interfax's SuperBrain, all Centronics printers, Omnitec data modems/couplers, NCR portable modem terminals. MFE digital cassette drives. **L & S Distributors, 44 So. Locust, Marlton NJ 08053, 983-7444.**

York PA

55-50 Bus Stop. Business & personal systems. Smoke, SWTP, Cimix, MSI, Exidy, TSC, Computerware, Jim-Pak, ACP, etc. Sales & service. Closed Sunday. **G. Y. C. Co., 51 Hamilton Avenue, York PA 17404, 854-0481.**

Houston TX

Experimenters' Paradise! Electronic and mechanical components for computer people, audio people, hams, robot builders, experimenters. Open six days a week. **Gateway Electronics, Inc., 8932 Clarkcrest, Houston TX 77063, 978-6575.**

REPLACE LINES 720 THRU 770 WITH THE FOLLOWING:

```
7 20 READ #0 X(T-1)*64+5,A35
7 30 WRITE #0 X(R-1)*64+5,A35,NOENDMARK
7 40 READ #0 X(T-2)*64+5,A35
7 50 WRITE #0 X(T-2)*64+5,A35
```

Main program changes.

```
FROM: 1 260 READ #0 X(F(I)-1)*64+5,PS\I#0,P(I),TAB(S),PS\NEXT\CLOSE #0
TO: 1 260 READ #0 X(F(I)-1)*64+5,A35\I#0,P(I),TAB(S),A35\NEXT\CLOSE #0
```

Changes to "Inventory."

Sort subroutine changes.

```
FROM: 4 30 P3=P3+1\IF P<=0 THEN 530 ELSE IF A3<>"N" THEN 120 ELSE 600
TO: 4 30 P3=P3+1\IF P<=0 THEN 525 ELSE IF A3<>"N" THEN 120 ELSE 600
```

ADD THE FOLLOWING TWO LINES

```
5 25 OPEN #0,"POINT"FOR I=1 TO Y\WRITE #0,P(I),NEXT
5 26 CLOSE #0
```

```
FROM: 1 40 FOR I=B TO N+B-1\K=(A1-I)\I1=I+1
TO: 1 40 FOR I=B TO N+B-1\K=(A1-I)\I1=I+1\IF I>ETHENEXIT180
```


Hex and ASCII

Do it with an ASCII keyboard.

Several months ago I set out to improve my acquaintance (then very limited) with microprocessors and to learn the mechanics of CPU interface. Experience being the best teacher, I elected to build from "scratch," designing and building as needed, rather than assembling any of the multitude of CPU kits currently available. This article is a natural evolution of that process and was put together in hopes that other fledglings might benefit from my experience.

An interface module capable of accepting the ASCII-coded outputs of a low-priced keyboard was needed (1) to convert certain of those codes into hexadecimal codes; (2) to reformat these codes to strobe out two characters in parallel; (3) to provide keyboard control of a CPU.

There is a great tendency in all of us (and I am equally guilty as the rest) to approach such a design problem from a "new and exotic" viewpoint. However, after the first pangs of exoticism had passed and I had returned to this earth, I

was able to work out a solution using commonly available components without waiting for the postman to deliver that one critical item six weeks hence... postmarked Timbuktu. This little jewel will meet all the requirements criteria at a price that will astound you.

Overview

To begin with, examine the keyboard output codes in Table 1. Note that the four lower-order bits for keys 0

and 1 through 9 are identical for both ASCII and hex but that ASCII recycles bits 1 through 4 starting at alpha character "A." Since we wish to use alpha characters A through F in hexadecimal, we must convert that to provide the essential hexadecimal codes in Table 1. Now examine the required versus available codes for alpha characters A through F in Table 1 again and note that adding the binary weight of 1001 to each character should provide the needed conversion to hex.

We have now established design criteria for the primary function of this interface — "pass numeric lower-order bits unaltered but modify alpha character lower-order bits by adding nine." Establishing this criteria brings out one more requirement — the ability to discriminate between alpha and numeric characters. Examine the codes in Table 2 and you will see that this discrimination can be accomplished by bits 2⁴ through 2⁶. All numerics have a 011 code for these bits while the alpha characters of interest carry a 100 coding in those same bits. Now, let's go

to Fig. 1 to apply what we have found.

The Circuit

In Fig. 1, the two hex inverters IC1 and IC2 provide active low outputs for ASCII codes 2⁰ through 2⁶, an E code and the keyboard strobe. These inverters can be eliminated if your particular keyboard can provide both true and false outputs for each of the required codes. Remember, saving two chips here requires that the number of conductors in the connecting cable be increased and that some buffering be lost at the conversion module end of the cable — a false economy!

IC3 examines bits 2⁴ through 2⁶. By using the false levels for 2⁴ and 2⁵, we establish coincidence for a low output at pin 12 for hexadecimal codes A through F. This output is inverted and fed as a mode control line to IC4 and IC6. A high on this line means CONVERT; a low prohibits conversion.

The necessary conversion is accomplished (as we determined earlier) by adding 9 to the alpha characters. We could utilize a four-bit adder or a PROM. However, a very low-priced chip (e.g., 7486 exclusive OR) can accomplish the same conversion if aided by a couple of AND gates and inverters.

The first step in the conversion is to invert 2³ during alpha characters. This is readily accomplished by feeding the mode control line to pin 2 of the 7486. Look at Fig. 1. You will see that any level at XOR pin 12 will be inverted only when pin 13 is high. Thus, we add 8 only during characters other than numeric. Adding 1 to the lower-order bit is more complicated because "carries" must be considered.

It is not the purpose of this article to review the basics of binary addition, so please bear with me when I say you must invert 2¹ if 2⁰ goes to a low as a result of addition. Assuming that we

Keyboard Code Formats
(Lower Four Bits Only)

KEY	HEX	ASCII
0	0000	0000
1	0001	0001
2	0010	0010
3	0011	0011
4	0100	0100
5	0101	0101
6	0110	0110
7	0111	0111
8	1000	1000
9	1001	1001
A	1010	0001
B	1011	0010
C	1100	0011
D	1101	0100
E	1110	0101
F	1111	0110

Table 1. Keyboard output codes.

do have a high mode line, pin 3 carries 2^0 inverted. This signal is, in turn, inverted by a segment of IC2 and fed to an AND gate segment of IC6 where it is passed only during alpha characters (Mode Control input to pin 9). The output of this gate, pin 8, is fed to the 2^1 segment of the XOR, IC4, where it, in turn, causes inversion of that

binary bit. This method of addition and carry is rippled up through bits 2^0 , 2^1 and 2^2 to accomplish an add 1 for these bits.

This ripple "add and carry" method works great until you get to alpha character D. At this point our "cheap" method blows up and senses a false inversion on bit 2^1 of the output causing

bit 2^2 to be inverted, with the result of D showing an output code of 1001 or the equivalent of a numeric 9.

The first two segments of IC1 and NOR gate IC5 are utilized to inhibit AND gate IC6-A on character D, thus preserving our ripple and carry approach. False inputs of 2^0 and 2^1 are fed to IC5, causing it to go low on the

output only during character D (examine Table 1 once again, only the D of alpha characters A-F has lows in 2^0 and 2^1 , simultaneously). This low on IC5 is what inhibits the conversion during character D. Pins 3, 6, 8 and 11 of the XOR carry the hex code outputs.

Our next step is to reformat these hex codes to strobe

				E	0	0	0	0	0	0	0	0	0	1
				2^6	0	0	0	0	1	1	1	1	1	0
				2^5	0	0	1	1	0	0	1	1	1	0
2^3	2^2	2^1	2^0	2^4	0	1	0	1	0	1	0	1	0	0
0	0	0	0		N			S	0	@	P			B
0	0	0	1		U			P	1	A	Q			R
0	0	1	0		L			I	2	B	R			K
0	0	1	1		S			"	3	C	S			C
0	1	0	0		T			#	4	D	T			L
0	1	0	1		X			\$	5	E	U			B
0	1	1	0		E			%	6	F	V			R
0	1	1	1		O			&	7	G	W			B
1	0	0	0		T			'	8	H	X			
1	0	0	1		E			(	9	I	Y			
1	0	1	0		N			)	:	J	Z			
1	0	1	1		A			+	;	K	[
1	1	0	0		C			,	<	L	\			
1	1	0	1		K			-	=	M]			
1	1	1	0		B			*	>	N	^	E		
1	1	1	1		E			/	?	O		S		
					L							C		
					S								D	
					I								E	

Table 2. ASCII codes for Archer keyboard.

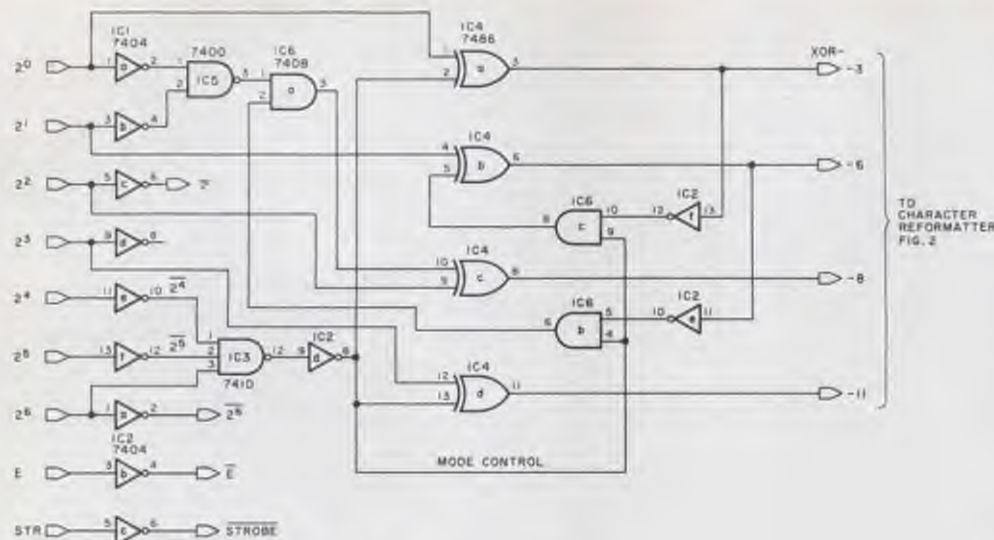


Fig. 1. ASCII/hex converter.

two characters out in parallel, meeting the 8-bit bus requirement of many of the popular CPUs. Fig. 2 is a single function diagram of the "shape-up and ship-out" reformatter. The requirement is to recognize when the operator wants to output a hex-formatted code. This recognition is accomplished by IC1, an 8-bit NAND gate. By feeding this gate appropriate true and false (2^2 and 2^6) ASCII outputs 2^0 through 2^6 , a low is achieved from a semicolon key.

IC4 is a 5-bit shift register. The inverted output of the recognition chip (pin 2, IC2) is combined with the keyboard strobe in AND gate IC3A to provide a load signal for the shift register, loading a 10000 sequence upon receipt of a ; signal. The clock for the shift register is provided at pin 6 of IC3B. This clock is inhibited while the keyboard is active with a semicolon. A four-bit latch is activated by the first parallel output bit (7496-15) and, therefore, loads the first hex character appearing on lines 2^0 through 2^3 of the code converter as shown in Fig. 1.

When the keyboard strobe appears after keying in the first hex character, the shift register shifts to the right to output a parallel code 01000. This code latches the first hex

word in IC5 and holds same as an interim memory. Outputs of the 4-bit latch are routed through a four-channel bilateral switch (IC6) to the CPU data bus D^4 through D^7 . The four lines 2^0 through 2^3 from the code converter are also routed through a four-channel bilateral switch (IC7) to CPU data bus bits D^0 through D^3 .

When the second hex character is entered from the keyboard, it is inhibited from entering the 4-bit latch due to the previous shifted pattern of the shift register. The shift

register, moving once more to the right with the keyboard strobe, enables AND gate IC3-C via pin 9, allowing the keyboard strobe to pass through this AND gate and enabling the CPU to strobe the two characters held at the bilateral gates (IC6, 7) onto the CPU data bus in parallel. These bilateral gates also appear as Tri-state outputs to the data bus, effectively preventing the loading of the bus except during the strobe pulse from the CPU when either 1 or 0 is presented to each of the 8 CPU data lines.

So far we have met two of our initial three objectives: We have provided code conversion, ASCII to hex, and reformatted to strobe out two hex characters in parallel to the CPU. It should be noted that while this process is being followed, the keyboard simultaneously provides ASCII-coded output one character at a time for character presentation on a TVT. The diagram for CPU control is presented in Fig. 3.

External Keyboard Control

In Fig. 3, IC3 and IC4 are each a control pair comprising AND gates cross-connected to latch in commands from a decoder, IC2.

The Archer keyboard used in this project presents an E bit on 2^7 output. This E bit appears for six non-ASCII-coded keys: BREAK, CTRL, CLEAR, HERE IS and two unmarked, uncommitted keys. The 7442 decoder (IC2) in Fig. 3 functions as a recognition circuit for these keys when presented with true signals from 2^0 through 2^2 plus a strobed E_5 input. NAND gate IC1 provides the strobed E signal and also serves as an inverter to provide the necessary active low input to IC2. The six decoded

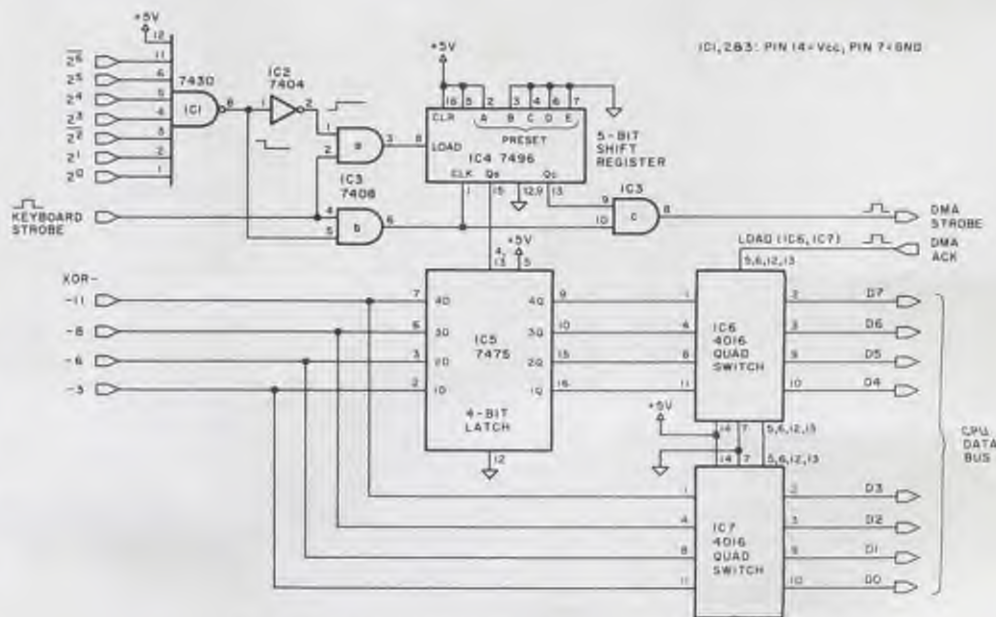


Fig. 2. Single function diagram of the character reformatter.

outputs appear as active low signals for BREAK, CTRL, CLEAR, HERE IS, LEFT BLANK and RIGHT BLANK.

When directed to the appropriate inputs of IC3 and IC4 as shown in Fig. 3, four keys have the ability to force latched outputs at output pins 1A, 1B. BREAK will cause a low at pin 1A and a high at pin 1B. This is WAIT logic for an RCA COSMAC CPU with which this interface module is now working. CLEAR causes a low on pin 1 of IC4 and a high at pin 1 of IC3. This is CLEAR logic for the same CPU. RUN provides highs at both output terminals, while HERE IS provides two lows at the same terminals.

Summary

This concludes the description of the interface module and its functions. Again, it is not exotic in form, but it does provide in a reliable manner three essential func-

tions of code conversion, re-formatting and CPU control. It can be constructed without real concern for critical layout of lead dress (the original was wire-wrapped on a Radio Shack prototype board) and all components are low cost and possibly available in your junk box.

In any event, the total

chip complement costs under \$5 at any of the several houses advertising in this magazine. The design is not without shortcomings. It does not provide for back-stepping in the case of erroneous entry, nor can it obviate illegal entry such as the keying in of shifted characters... but what can you

expect for less than \$5? Plans are currently underway to add back-spacing capability for program correction and rapid program step through for entry verification. The latter is considerably more useful to limited systems without CRT display than to those lucky people with TVT connections. ■

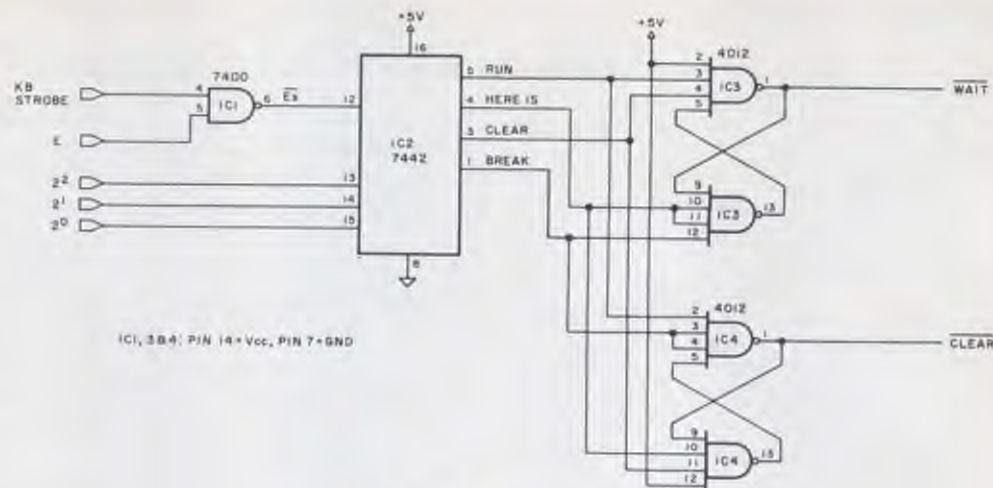


Fig. 3. CPU control.

We bought 350,000 LED's.

And you get the savings.

Reds, greens, yellows, orange, small, medium, large. Bags of 25 - mixed \$2.75. That's only 11¢ each. Compare this bargain up to twice our price.

FACTORY PRIME

5BI - Polar LED 59¢ ea. or 10 for \$5

LAB-BENCH VARIABLE POWER SUPPLY KIT

5 to 20 VDC at 1 AMP. Short circuit protected by current limit. Uses IC regulator and 10 AMP Power Darlington. Very good regulation and low ripple. Kit includes PC Board, all parts, large heatsink and shielded transformer. 50 MV. TYP. Regulation. \$15.99 KIT

LED BAR GRAPH AND ANALOG METER DRIVER

New from National Semi. #LM3914. Drives 10 LED directly for making bar graphs, audio power meters, analog meters, LED oscilloscopes, etc. Units can be stacked for more LED's. A super versatile and truly remarkable IC. Just out!

SPECIAL PRICE: \$3.99 INCLUDES 12 Page Spec. Sheet

CLOCK MODULE OPTIONS

MA1008 A and D MA1013

Switches and pot for all options.

Includes:

5 push buttons

1 toggle

1 10K pot

\$2.50

Alarm Parts (including high impedance transducer) Much more efficient than a speaker.

\$1.50

Transducer only (unbelievably loud!) \$1.10

16K DYNAMIC RAM CHIP

WORKS IN TRS-80 OR APPLE II

16K X 1 Bits. 16 Pin Package. Same as Mostek 4116-4. 250 NS access. 410 NS cycle time. Our best price yet for this state of the art RAM. 32K and 64K RAM boards using this chip are readily available. These are new fully guaranteed devices by a major mfg.

VERY LIMITED STOCK!

"MAGAZINE SPECIAL" - 8/\$79.50

SONY 23 WATT AUDIO AMP MODULE

#STK-054. 23 WATTS SUPER CLEAN AUDIO. 20 HZ to 100 KHZ \pm 2 DB. HYBRID, SILICON, SELF-CONTAINED MODULE. ONLY 1 3/4 x 2 1/4 IN. WITH DATA.

COMPARE AT UP TO TWICE OUR PRICE! \$6.50 each

50 Hz CRYSTAL TIME BASE

\$4.95 (Complete Kit)

Uses MM5369 CMOS divider IC

with high accuracy 3.579545

MHZ Crystal. Use with all MOS

Clock Chips or Modules. Draws

only 1.5 MA. All parts, data and

PC Board included. 100 Hz,

same as above, except \$5.95.

MICRO MINI

TOGGLE SWITCHES

6 for \$5 with hardware.

Sound Activated Switch not a kit. Already assembled. Clap your hands and turn on lights, music boxes, coffee pots, etc. Full spec. sheet with each unit.

69¢ ea. 10 for \$5.50

FAIRCHILD PNP

"SUPER TRANSISTOR"

2N4402. TO-92 Plastic. Silicon PNP

Driver. High Current. VCE0-40 HFE-

50 to 150 at 150 MA. FT-150 MHZ. A

super "BEEFED-UP" Version of the

2N3906.

8 FOR \$1.19

JUMBO IC ASSORTMENT

All new not rejects. BIG

computer mfg. Surplus. Some

standard marked, many house

numbered. TTL, DTL, LINEAR.

All prime. 1st line.

50 for \$1.59 500 for \$12.95

NATIONAL SEMICONDUCTOR

"COLOSSUS JR." JUMBO CLOCK MODULE

MA1013

BRAND NEW!

ASSEMBLED! NOT A KIT!

MANUFACTURER'S CLOSEOUT!

PERFECT FOR USE WITH A TIMEBASE.

\$8.50

2 FOR \$15

(AC XPMR \$1.95)

- Bright 4 digit 0.7" LED Display
- Complete-Add only Transformer and Switches
- 24 Hour Alarm Signal Output
- 12 Hour Real Time Format
- 50 or 60 Hz Operation
- Power Failure Indication
- LED Brightness Control
- Sleep and Snooze Timers
- Alarm "on" and PM Indicators
- Direct Drive - No RFI
- Direct Replacement for MA1012
- Comes with Full Data

TOSHIBA POWER AUDIO AMP

5.8 WATTS RMS Typical Output. 50 to 30,000 HZ \pm 3 DB. For CB's, tape decks, PA's, etc. Works off of a single supply voltage from 10.5 to 18 VDC. 10 Pin plastic DIP with special built in heat sink tab.

Perfect for use on 12VDC.

With Data. \$3.99 each

Digital Research: Parts

(OF TEXAS)

P.O. BOX 401247 • GARLAND, TEXAS 75040 • (214) 271-2461

TERMS: Add 50¢ postage, we pay balance. Orders under \$15 add 75¢ handling. No C.O.D. We accept Visa, MasterCard and American Express cards. Tex. Res. add 5% Tax. Foreign orders (except Canada) add 20% P&H. 90 Day Money Back Guarantee on all items.

Write for our free catalog full of many useful bargains.

SECURITY for TRS-80 DISC DRIVE OWNERS



- **BUSINESSMEN** - Ensure the privacy of your Corporate Files
- **PROGRAMMERS** - Protect Programs/Data Files
- **RS232 USERS** - Foil wiretaps with Super Cipher
- **AMATEUR RADIO** - Baffle eavesdroppers with Super Cipher

CIPHER for security at the Confidential level. Cipher is a sophisticated cryptographic system which is impervious to all Master DOS passwords. Codes of up to 11 alphanumeric characters accepted. Cipher is supplied with its own self-chaining disk operating system, but will accept DOS 2.1, 2.2 or 2.3 files.

\$39.95

SUPER CIPHER for security at the Top Secret level. Super Cipher accepts codes of up to 256 alphanumeric characters. This is the code for special business or military applications.

\$99.95

AUTHORS — DISTRIBUTORS — SYSTEM HOUSES

- **DOUBLE AND TRIPLE YOUR SALES**
- **CURTAIN COPYRIGHT VIOLATIONS**
- **PREVENT ILLEGAL DISC DUPLICATION**
- **THWART PROGRAM EXAMINATION DURING EXECUTION**

We will customize your program so that it will execute, but can not be examined regardless of any effort to disable the protection. Our technique is impervious to both Master DOS passwords and alien DOS systems. Send us your program together with a \$40 encipherment fee. If we consider the cryptographic problem acceptable, we will encipher your program and return the encrypted version to you. Otherwise your \$40 fee will be promptly refunded. Examine and test our diskette - complete with its own copyrighted DOS system - to see if the level of encipherment is adequate. If you are satisfied we will then supply duplicates in lots of fifty at a fixed charge per diskette.

P.O. Box 516 • Troy, Idaho 83871 • **SOLARIS PRESS** • Specify 32K or 48K • (208) 835-5391 • S123

TRS MOD I and MOD II PROGRAMS FROM RACET COMPUTES

∞ BASIC for Level II and Disk Systems \$49.95

Full MATRIX Functions - 30 BASIC commands!!
Mathematical and common matrix functions. Change arrays in mid-program. Complete array handling. Tape array read and write, including strings. Common subroutine calls.

Over 50 more STRING Functions as BASIC commands!! String manipulation, translation, compression, copying, search, screen control, pointer manipulation and utility functions. Includes multikey multivariable machine language sorts. Load only machine language functions that you want! Where you want in memory! Relocating linking loader! More than you ever expected!!

∞ BUSINESS (Requires Infinite BASIC) \$29.95

20 Business oriented functions including:
Printer Automatic Pagination with headers and footers!
Packed Decimal Arithmetic (+, -, *, /) 127 digits!
Binary array searched and hash code generator!

COMPROC Command Processor for Disk Systems \$19.95

Auto your disk to perform any sequence of DOS commands, machine language loads, BASIC, memory size, run program, respond to input statements, etc. Single BASIC command file defines execution! Includes auto key-debounce, screen print and lower case software driver.

New Products Jan/Feb! We answer reader response inquiries!!

ATTN/ System Houses - We license usage of our routines!
TRS Add-On OEM's - Direct BASIC commands tailored for your hardware.

REMODEL + PROLOAD Specify 16, 32, or 48K Memory \$34.95
RENUMBER any portion or all of BASIC program. Line references adjusted.

MOVE any portion of a BASIC program from one location to another.

DELETE lines or ranges of lines while using the utility.

MERGE all or any portion of a program from tape. (Load lines 300-500 from your tape to existing program at line 1000 with renumbering on the way in!)

SAVE combined/merged programs, or any portion to tape with VERIFY.

COPYSYS Copy Systems Tapes (Editor/Assembler Format) \$14.95

GSF (16, 32, or 48K) \$24.95

18 Machine language routines using 'USR' calls. Includes RACET sorts, array handling, and fast lines and scrolls.

DOSORT (Specify 32 or 48K - 2 disk minimum) \$34.95

Sort/Merge multi-diskette sequential files. Multiple keys and variables. Includes GSF - machine language sorts, comparators and string handling.

MOD II SUPPORT

RACET is supporting the MOD III!!

Call or write for current information! We have a MOD II Superzap and other assembly language tools!

Ask your dealer if he carries our products!

DEALERS! We will work with you directly or through our distributors.

✓ R24


702 Palmdale, Orange CA 92665

CHECK, VISA, M/C, C.O.D. • Calif. Residents add 6% • Telephone Orders Accepted (714) 637-5016
WHEN ORDERING PLEASE ADVISE PUBLICATION SOURCE

DATA TERMINAL EQUIPMENT — FROM MICROMAIL



LA34 DECwriter IV

\$1,199.00

- Upper/lower case, 9x7 dot matrix
- 10, 12, 13.2, 16.5 characters/inch
- 2, 3, 4, 6, 8 or 12 lines/inch
- 22"W x 7"H x 15 1/2"D, 25 lbs.
- 110 or 300 baud, RS 232C serial ASCII
- Friction feed, paper width to 15"

SOROC IQ 120 \$795.00

- RS 232C, upper/lower case, full ASCII
- Numeric keypad, protected fields
- Cursor keys plus addressable cursor
- Auxiliary extension port



SOROC IQ 140 \$1,250.00

- RS 232C and 20mA current loop
- Extensive editing features
- 25th line terminal status display
- 16 function keys (32 with shift)



New from DIABLO

DIABLO 1640 **\$2,690.00**

Receive-only **\$2,331.00**

High-quality daisywheel printing at 45 cps.

DIABLO 1650 **\$2,779.00**

Receive-only **\$2,419.00**

Metal daisywheel printing at 40 cps.

T.I. 810 printer **\$1,695.00**

- Includes upper/lower case
- 150 characters per second
- RS 232C serial interface
- Adjustable forms tractor



NEC Spinwriter

Call or write for prices

To Order: Send certified check (personal or company checks require two weeks to clear) including handling* and 6% sales tax if delivered within California.

*Handling: Less than \$2,000, add 2%; over \$2,000, add 1%. Everything shipped freight collect in factory cartons with manufacturer's warranty.

MICROMAIL

MICROMAIL • BOX 3297 • SANTA ANA, CA 92703
(714) 731-4338 ✓ M73

Want to REALLY UNDERSTAND The BASIC Language?

From the author of the highly acclaimed TRS-80 Users/Learners Manual comes the book you've been asking for! The **BASIC Handbook** is THE definitive reference and "idea" book, explaining in detail the BASIC language as used in over 50 favorite micros, minis and mainframes.

It's not a dictionary, and not a textbook, but a virtual ENCYCLOPEDIA of the BASIC language. In it is everything you need to know about the most important BASIC statements, functions, operators and commands, explained in a way that you can put them right to work.

This HANDBOOK is written to be used!

With the BASIC Handbook you can finally make those programs found in magazines run on your computer — or know the reason why they can't.

If there is an alternate way to write a program using other BASIC words, the Handbook shows you how. If there is a function needed but your machine doesn't have it, the Handbook gives you a subroutine that accomplishes the same thing. About the only thing it won't help you with is an additional 16K of memory.

Is TRS-80 Level II covered — YES!

Is PET covered — YES!

Is Apple covered — YES!

Sorcerer, Altair, Imsai, Etc.

YES . . . and over 50 more!

COMPUSOFT™ PUBLISHING

A Division of CompuSoft, Inc.
8643 Navajo Road
San Diego, California 92119

✓ C109



360 pages
Soft Cover

30-Day money back
Guarantee

Order Today!

YES, I need the BASIC HANDBOOK
CompuSoft Publishing 8643 Navajo Road San Diego, CA 92119
Please send _____ copies of The BASIC Handbook. My check
for \$14.95 each + \$1.35 P & H is enclosed. (California
add 6% tax)
Name _____ Address _____
City _____ State _____ Zip _____

I understand my handbook will be shipped promptly and there is a 30-day money back guarantee.

My Computer is a _____

THE PERFECT
CHRISTMAS GIFT



GROW WITH US AS
COMPUCOVER EXPANDS
TO MEET YOUR NEEDS
IN THE 1980's
Dealer Inquiries Invited
Club Discounts Available

COMPUCOVER®

ORDER NOW
FOR CHRISTMAS



- Cloth Backed Naugahyde Vinyl
- Waterproof & Dustproof
- Longer Life
- Improved Reliability
- Three Decorator Colors
Saddle Tan • Electra Blue • Black

TO ORDER:
Include \$1.00 for
Postage & Handling
Send Check or Money Order To
CompuCover
P.O. Box 324 Dept. A
Mary Esther, FL 32569
Phone (904) 243-5793

TRS-80
Keyboard\$7.95
Cassette3.95
Video Display9.95
Set19.95

APPLE II
Keyboard\$9.95
Disk3.95
Set11.95

Sorcerer\$9.95
TRS-80 Disk4.95
Double Disk6.95
Percom Disk4.95
Lobo Disk6.95
Matchless Disk6.95

CENTRONICS
779\$17.95
7309.95
P-I9.95
DECWRITER
36\$19.95
12019.95

Wang Terminal\$18.95
Wang w/disk22.95
Trendcom 1009.95
Soroc IQ 12018.95
Pet19.95

★ EXCITING MAIL ORDER DISCOUNTS ★



NOVATION CAT

ACOUSTIC MODEM

- ANSWER ORIGINATE
- 300 BAUD
- BELL 103
- LOW PROFILE DESIGN

\$179.00

MICROPOLIS™ MetaFloppy DRIVES



1043 (Single) 315Kb\$995.00
1053 (Dual) 630Kb\$1695.00

- QUAD DENSITY DESIGN
- COST EFFECTIVE STORAGE
- 4 TIMES STANDARD CAPACITY
EVEN AFTER FORMATTING!



Apple II^{16k}
OR APPLE II PLUS
\$975.00

- COLOR • GRAPHICS • SOUND
- APPLE DISK II \$495.00
INCLUDES CONTROLLER

SD EXPANDORAM

- 64K 5-100 DYNAMIC RAM BOARD
- WORKS WITH Z-80, 8080 & 8085
- POWER CONSUMPTION 5 WATTS
- BANK SELECT • PHANTOM REFRESH
- NO WAIT STATES REQUIRED

WITHOUT MEMORY\$149.00
16K KIT215.00
32K KIT269.00
48K KIT349.00
64K KIT409.00

ADD \$50 FOR ASSEMBLED & TESTED

✓C174

PORTABLE MINISCOPES

LOW POWER CONSUMPTION

MS-15 SINGLE TRACE 15 MHz \$289
MS-215 DUAL TRACE 15 MHz \$389
MS-230 DUAL TRACE 30 MHz \$519



2.9" HIGH
6.4" WIDE
8.5" DEEP

SOROC IQ 120

- SERIAL RS232C
- FULL ASCII UPPER/LOWER CASE
- NUMERIC KEYPAD CURSOR KEYS
- SCREEN CONTROL & PROTECTED FIELDS

\$775.00



LEEDEX VIDEO 100

- 12" BLACK & WHITE MONITOR
- VIDEO BANDWIDTH 12MHz ± 3db
- COMPOSITE VIDEO INPUT

\$129.00



• TO ORDER •

Phone orders invited, using credit cards. Or send personal check or money order. Add 1% for packing and handling. California residents add 6% sales tax. All equipment is shipped freight collect in factory carton with manufacturer's warranty. All equipment subject to availability and price change without notice.



VISA



COMPUTER SPECIALTIES

6363 EL CAJON BLVD., SUITE 305,
SAN DIEGO, CA. 92115 • (714) 579-0320

Interrupting BASIC

With this article and a source listing, you can do it.

D. H. Willits
E. H. Wiser
NC State University
Box 5906
Raleigh NC 27650

We have been developing an 8080-based microprocessor system for data acquisition and environmental control in greenhouses used for energy research. The data acquisition function requires as many as 15 data points to be read periodically (some as often as once per minute) and the data processed for output at half-hour intervals. The control function requires certain points to be read and the information processed on 15 second cycles so

that heaters, vent fans and cooling pads can be properly controlled. A further requirement is that the system be capable of responding to commands entered from the keyboard at any time.

Data acquisition and control functions can easily be handled with polling loops, but in this application the requirement for random access to the control and data acquisition program made polling cumbersome. Utilizing interrupts to initiate action seemed to provide the answer, but it also presented us with a problem. We want to program mostly in BASIC, rather than assembly language, but the BASIC interpreters available have no provisions for servicing interrupts.

This article discusses three approaches developed to over-

come this problem: (1) handling the interrupt in assembly language with a return to the point of interrupt in the BASIC program; (2) handling the interrupt in BASIC with no return to the point of interrupt; (3) handling the interrupt in BASIC with a return to the point of interrupt in the BASIC program. Each approach has advantages and disadvantages that depend on the particular application.

The BASIC interpreter we used is Cromemco's 3K Control BASIC (CB), but all the techniques used should apply to other interpreters, provided you have access to the source listing for the interpreter. A fully commented source listing is easier to work with, but it can be done with just a listing from a disassembler if you're dedicated enough and are proficient at reading assembly language.

Handling Interrupts in Assembly Language

The simplest way to handle

interrupts is to process them in an assembly-language subroutine with a return to the BASIC program that was executing at the time of interrupt. Table 1 shows the assembly language required, and Fig. 1 shows the activity flow between the CB programming and the interrupt handler. Our system has vectored interrupt capability so that eight separate interrupt signals can be handled, each causing transfer to one of eight different memory locations between %0000 and %003F. (The % symbol is used to designate hexadecimal numbers throughout the text. The exception is in the assembly listings, where hex numbers are suffixed with an H according to standard practice.)

An EI (enable interrupt) command must be executed before the microprocessor will recognize an interrupt, and a mask word is required to disable unwanted interrupts. These steps are included in the initialization routine 'INIT'.

We chose the interrupt that

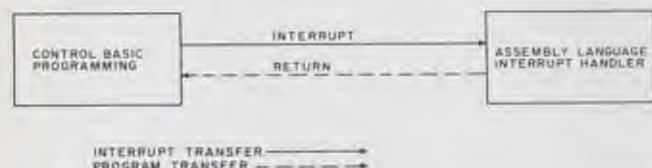


Fig. 1. Activity flow for handling interrupts in assembly language.

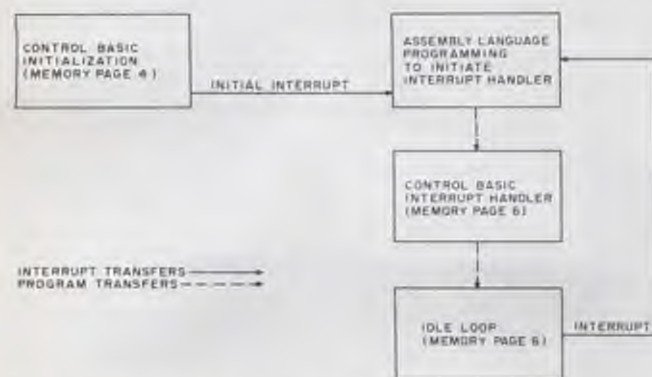


Fig. 2a. Activity flow for limited handling of interrupts in BASIC, Version I.

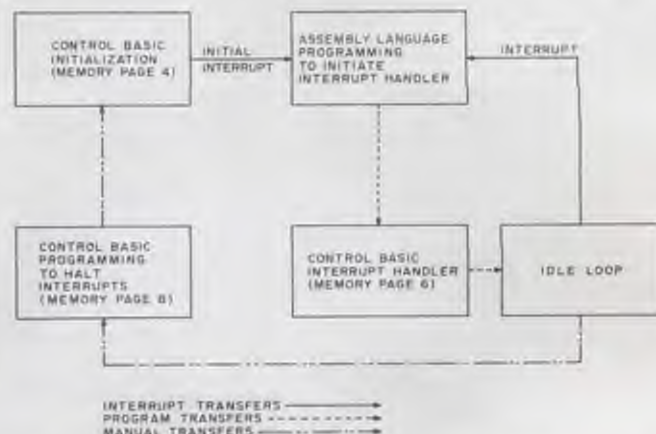


Fig. 2b. Activity flow for limited handling of interrupts in BASIC, Version II.

transfers control to location %0008 and masks the rest. The JMP instruction at %0008 transfers control to %0040 where the interrupt service (which can be any assembly-language routine) is executed. Control is then returned to the BASIC program at the point of interrupt.

Note that the status word and registers must be saved in order to reenter the interrupted program. Note also that the interrupt service includes an EI command because the microprocessor disables interrupts as soon as an interrupt is received. Initiation of interrupt service is done by typing a CALL %0060.

This approach is simple and effective, provided that the task to be performed during interrupt service does not require mathematical computation or extensive manipulation. It requires little knowledge of the interpreter itself, beyond knowing where the interrupt handler can be stored. CB does not use the first two pages of memory, so locations up to %01FF are available.

A way to use BASIC to manipulate data read during the interrupt is available when variables are stored at fixed locations. CB stores 52 variables denoted by letters A through Z and A0 through Z0 in the first 104 bytes of memory page 3 (%0200-%0267). The interrupt handler can be used to store data at these locations. A BASIC program could be used to test the contents to determine whether an interrupt had occurred. This is the procedure recommended by Mits for use with the Altair real-time clock.

Limited Interrupt Handling in BASIC

Handling interrupts in assembly language is fairly difficult if calculation or output is required. There are obvious advantages of programming in BASIC to handle these situations, but this necessarily requires more knowledge of the programming of the interpreter. This approach is a relatively limited one that has some practical applications.

Suppose the main program does essentially nothing until an interrupt occurs. The inter-

0008	C3 40 GO	JMP INTR	
0040	F5	INTR	PUSH PSW
0041	E5		PUSH H
0042	D5		PUSH D
0043	C5		PUSH B

Interrupt Processing
goes here

005A	C1	POP B	
005B	D1	POP D	
005C	E1	POP H	
005D	F1	POP PSW	
005E	FB	EI	
005F	C9	RET	
0060	3E FD	INIT	MVI A,OFDH
0062	D3 0A		OUT 10
0064	FB		EI
0065	C9		RET
		PSW	EQU 6

/SAVE STATUS WORD AND REGISTER
/CONTENTS ON CB STACK.

/PROCESS INTERRUPT: ANY ASSEMBLY
/LANGUAGE PROGRAM CAN BE PLACED
/HERE. THE SPACE NEED NOT BE
/RESTRICTIVE IF SUBROUTINES AND
/JUMPS ARE USED.
/RESTORE REGISTER CONTENTS AND
/STATUS WORD.

/ENABLE INTERRUPTS AND RETURN.

/THIS SUBROUTINE INITIALIZES THE
/INTERRUPTS: A MASK WORD IS OUTPUT
/TO ELIMINATE UNWANTED INTERRUPTS
/(NOTE: THE ACTUAL MASK WORD AND
/OUTPUT PORT ARE SYSTEM DEPENDENT.
/CHECK YOUR SYSTEM MANUAL FOR
/DETAILS). ENABLE INTERRUPTS AND
/RETURN.

Table 1. Assembly-language programming and machine code for handling interrupts.

(Memory Page 4)

```

10 REM INITIALIZATION
20 REM LOAD MACHINE CODE FOR INTERRUPT SERVICE ROUTINE, 'LOAD' (FIGURE 3)
30 PUT(%0040) = %06, %07, %11, %69, %02, %21, %59, %00
40 PUT(%0048) = %7E, %12, %13, %23, %05, %C2, %48, %00
50 PUT(%0050) = %1B, %1B, %21, %00, %00, %FB, %C3, %42
60 PUT(%0058) = %E4, %52, %55, %4E, %20, %36, %0D, %FF
70 REM LOAD MACHINE CODE FOR INITIALIZATION ROUTINE, 'INIT'
80 PUT(%0060) = %3E, %FD, %D3, %0A, %FB, %C9
90 REM SET JUMP AT %0008
100 PUT(%0008) = %C3, %40, %00
110 REM OTHER INITIALIZATION GOES HERE, IF ANY
120 REM ENABLE INTERRUPTS BY CALLING 'INIT'
130 CALL %0060
140 STOP

```

(Memory Page 6)

```

10 REM INTERRUPT HANDLER
20 REM ANY PROCESSING GOES HERE
30 REM ENTER IDLE LOOP TO WAIT FOR NEXT INTERRUPT
40 GOTO 40
50 STOP

```

Table 2a. BASIC programming for limited interrupts, Version I.

(Memory Page 4)

```

10 REM INITIALIZATION
20 REM LOAD MACHINE CODE FOR INTERRUPT SERVICE ROUTINE ('LOAD') HERE
30 REM LOAD MACHINE CODE FOR INITIALIZATION ROUTINE ('INIT') HERE
40 REM SET JUMP AT %0008
50 REM OTHER INITIALIZATION GOES HERE, IF ANY
60 REM ENABLE INTERRUPTS BY CALLING 'INIT'
70 STOP

```

(Memory Page 6)

```

10 REM INTERRUPT HANDLER
20 REM ANY PROCESSING GOES HERE
30 REM INTERPRETER RETURNS TO ITS OWN IDLE LOOP (NOT SHOWN) TO AWAIT INPUT FROM KEYBOARD

```

(Memory Page 8)

```

10 REM INTERRUPT HALT
20 REM LOAD ASSEMBLY LANGUAGE TO PERFORM HALT
30 PUT(%0100) = %F3, %C9
40 REM CALL HALT ROUTINE
50 CALL %0100
60 STOP

```

Table 2b. BASIC programming for limited interrupts, Version II.


```

0008 C3 40 00      JMP LOAD
0040 06 07      LOAD MVI B,7          /LOAD 'RUN 6' INTO INTERPRETER AND
0042 11 69 02      LXI D,0269H        /JUMP TO BASIC: PUT LENGTH OF STRING
0045 21 59 00      LXI H,STR          /((INCLUDING SPACES, CR, AND TRAILING
0048 7E          LP MOV A,M           /FFH) INTO B, PUT COMMAND STRING
0049 12          STAX D               /LOCATION INTO DE, GET ASCII STRING
004A 13          INX D                /'RUN 6' AND STORE IN COMMAND STRING
004B 23          INX H                /LOCATION, ENABLE INTERRUPTS AND JUMP
004C 05          DCR B                /TO THE INTERPRETER AT LOCATION E442H.
004D C2 48 00      JNZ LP
0050 1B          DCR D
0051 1B          DCR D
0052 21 00 00      LXI H,0000
0055 FB          EI
0056 C3 42 E4      JMP OE442H
0059 52 55 4E      STR ASC 'RUN 6'    /THIS IS THE ASCII STRING, 'RUN 6',
005C 20 36          /FOLLOWED BY A CR AND AN FFH.
005E 0D FF          DW OFF0DH
0060 3E FD      INIT MVI A,OFDH       /THIS SUBROUTINE INITIALIZES THE
0062 D3 0A      OUT 10                /INTERRUPTS: OUTPUT MASK WORD TO
0064 FB          EI                  /ELIMINATE UNWANTED INTERRUPTS.
0065 C9          RET                  /ENABLE INTERRUPTS AND RETURN.

```

Table 3. Assembly-language programming and machine code for limited interrupt service.

```

(Memory Page 4)

10 REM INITIALIZATION
20 REM LOAD MACHINE CODE FOR INTERRUPT SERVICE ROUTINES HERE IF DESIRED
30 REM LOAD MACHINE CODE FOR INITIALIZATION ROUTINE ('INIT') HERE
40 REM SET JUMP AT %0008
50 REM OTHER INITIALIZATION GOES HERE, IF ANY
60 REM ENABLE INTERRUPTS BY CALLING 'INIT'

```

```

(Memory Page 6)

10 REM INTERRUPT HANDLER
20 REM ANY PROCESSING GOES HERE, RETURN WHEN FINISHED BY CALLING 'REPL.'
30 CALL %0096

```

Table 4. BASIC programming for full interrupt service.

rupt is serviced and then the program waits for the next interrupt. Provided that any interrupt can be completely serviced before the next one occurs, the main program will always be in an idle state at the time of interrupt, and it is not necessary to return to this point. This would be true, for example, for interrupts occurring on a regular schedule, such as clock pulses, but not true for random interrupts coming from the keyboard or from another device.

The BASIC program required is shown in Table 2a and the accompanying Fig. 2a. It consists of three main parts: (1) an initialization routine starting on memory page 4; (2) the interrupt handler starting on memory page 6; (3) the idle loop following the interrupt handler. The initialization routine is executed first by typing the command RUN. This stores the machine code for the assembly-language routines and performs any other ini-

tialization written in by the user. The last step is to execute the CALL %0060 command, which will enable the interrupts.

Since there is usually an interrupt request present when clock signals are being used for interrupting, execution of the EI command will initiate the interrupt service, which in turn transfers control to memory page 6. The idle loop is entered when the interrupt processing is finished.

A more sophisticated version of the same program can be written if we realize that the interpreter provides a loop of its own (while checking for keyboard input) that can take the place of the idle loop. Return to the interpreter loop is accomplished by omitting the STOP command from the routine stored on memory page 6. When Control BASIC encounters an end-of-file before a STOP is reached, the interpreter types an OK and a > and enters the loop waiting for input. This pro-

vides visual feedback to signify the end of interrupt processing and allows a short routine to be executed from the keyboard if desired (perhaps to disable interrupts).

Table 2b shows this version of the program with the idle loop at the end of the interrupt handler

being eliminated and a routine, added on memory page 8, which loads a DI (disable interrupt) command and a RET at %0100 and then executes a CALL %0100 to stop the interrupts. The routine is executed by typing RUN 8 while the keyboard is active. This provides time to correct programming (during program development), execute a longer routine (say a memory dump) or perform any function desired by the user. The interrupt service is restored by typing a CALL %0060 command, which reenables the interrupts and starts the process again. The interaction among the various routines is shown in Figure 2b.

The execution of the routine on memory page 6 is made possible by a feature of Control BASIC that allows separate routines to be stored in different pages of memory, and a RUN command (followed by a page number) transfers control to the routine stored on that page. In this case, the interrupt service must create a RUN 6 and force the interpreter to execute the command as if it had been entered from the keyboard. In order to do that we had to determine how the interpreter handled those commands.

When a command is entered from the keyboard it is stored as a character string in memory locations starting at %0269. A trailing carriage return (CR) and %FF are added to denote the end of the string, and the interpreter jumps to location %E442 with the contents of the DE reg-

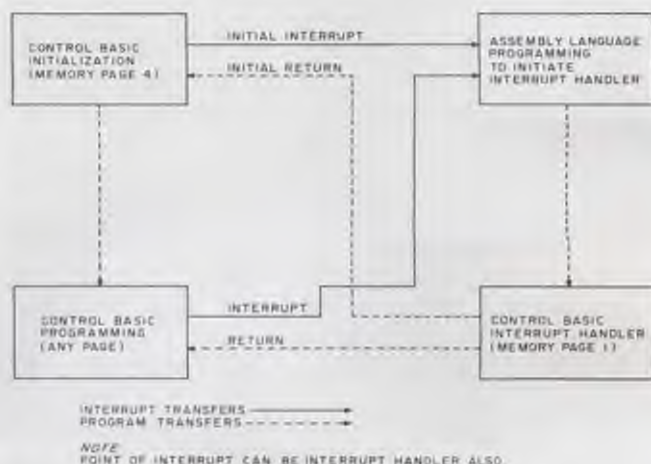


Fig. 3. Activity flow for full interrupts service in BASIC.

ister pointing to the CR and the HL register set to zero. The command is then executed by the interpreter. Table 3 shows an assembly-language simulation of this. Note that the character string RUN 6 is stored, and then a jump is executed to %E442.

This approach has the advantage of being able to process interrupts in BASIC with only a limited requirement for assembly-language programming. The disadvantage is that a program executing at the time of interrupt cannot be continued. This can severely limit what can be accomplished if the time between interrupts is short. Since our situation demanded a 15 second cycle, we had to keep trying.

Full Interrupt Handling in BASIC

Our final approach permits full interrupt processing in BASIC. A BASIC routine may be interrupted at any point (including within FOR/NEXT loops), and the interrupt is serviced in a BASIC subroutine. When the service is finished, execution continues at the point of interrupt. Furthermore, the basic interrupt service itself may be interrupted, which provides a great deal of flexibility in programming.

This is the most practical approach for our application, but it requires a more extensive knowledge of the interpreter and requires the most memory to execute. If we wish to interrupt a BASIC program, execute another BASIC program and then return to the point of interrupt, we must save the contents of all of the registers as in the previous example (eight bytes). We must also save all of the pertinent interpreter control variables (30 bytes) and that portion of the command string stored at %0269 that will be written over by the RUN 6 command and the trailing CR and %FF (eight bytes). Note that only seven bytes of the command string actually need to be saved if only a single digit-page number is used in the RUN command. However, it is recommended that the program be written to save eight bytes of the

0008	C3 6E 00		JMP SAVE	
000E	F5	SAVE	PUSH PSW	/SAVE STATUS WORD AND REGISTERS
000F	E5		PUSH H	/ON STACK.
0070	D5		PUSH D	
0071	C5		PUSH B	
0072	3E 0F		MVI A,0FH	/SAVE CONTROL VARIABLES:
0074	21 DE 03		LXI H,03DEH	/LOAD NO. OF BYTE PAIRS INTO A; PUT
0077	CD B7 00		CALL STORE	/DESTINATION INTO HL AND CALL STORE.
007A	3E 04		MVI A,04H	/SAVE PORTION OF COMMAND STRING:
007C	21 69 02		LXI H,0269H	/LOAD NO. OF BYTE PAIRS REQUIRED BY
007F	CD B7 00		CALL STORE	/RUN 6 (INCLUDING CR AND FFH) INTO A.
0082	2A 00 01		LHLD 0100H	/SAVE STACK POINTER ADDRESS: PUT
0085	EB		XCHG	/MEMORY POINTER IN DE; PUT OLD STACK
0086	21 00 00		LXI H,0000H	/POINTER ADDRESS INTO HL; MOVE TO DE
0089	39		DAD SP	/AND RETURN MEMORY POINTER TO HL.
008A	EB		XCHG	/STORE LOW BYTE OF OLD SP INTO
008E	73		MOV M,E	/MEMORY LOCATION ADDRESSED BY HL,
008C	23		INX H	/STORE HIGH BYTE IN HL + 1; INCREMENT
008D	72		MOV M,D	/HL TO POINT TO NEXT AVAILABLE
008E	23		INX H	/MEMORY LOCATION AND STORE AT 0100H.
008F	22 00 01		SHLD 0100H	
0092	FB		EI	/ENABLE INTERRUPTS AND JUMP.
0093	C3 40 00		JMP LOAD	
0096	2A 00 01	REPL	LHLD 0100H	/RETRIEVE STACK POINTER ADDRESS:
0099	2B		DCX H	/LOAD MEMORY POINTER FROM LOCATION
009A	56		MOV D,M	/0100H; MOVE HIGH BYTE TO D; MOVE
009B	2B		DCX H	/LOW BYTE TO E; STORE NEW MEMORY
009C	5E		MOV E,M	/POINTER; MOVE OLD SP ADDRESS
009D	22 00 01		SHLD 0100H	/(IN DE) TO HL; MOVE CURRENT SP
00A0	EB		XCHG	/TO OLD POSITION TO RECLAIM STORED
00A1	F9		SPHL	/INFORMATION.
00A2	21 70 02		LXI H,0270H	/RESTORE OLD COMMAND: LOAD COMMAND
00A5	3E 04		MVI A,04H	/STRING LOCATION INTO HL, NO. OF BYTE
00A7	CD C3 00		CALL RETRV	/PAIRS INTO A, CALL RETRV.
00AA	21 FB 03		LXI H,03FBH	/RESTORE OLD CONTROL VARIABLES: LOAD
00AD	3E 0F		MVI A,0FH	/ENDING LOCATION INTO HL; LOAD NO. OF
00AF	CD C3 00		CALL RETRV	/BYTE PAIRS INTO A, CALL RETRV.
00B2	C1		POP B	/RESTORE REGISTERS AND STATUS WORD.
00B3	D1		POP D	
00B4	E1		POP H	
00B5	F1		POP PSW	
00B6	C9		RET	
00B7	C1	STORE	POP B	/THIS SUBROUTINE TAKES INFORMATION
00B8	5E	LOOP1	MOV E,M	/FROM MEMORY AND PUSHES IT ONTO THE
00B9	23		INX H	/CB STACK IN TWO-BYTE WORDS. THE NO.
00BA	56		MOV D,M	/OF BYTE PAIRS PUSHED IS DETERMINED
00BB	D5		PUSH D	/BY A: POP THE RETURN ADDRESS AND
00BC	23		INX H	/SAVE IT IN BC, MOVE BYTE ADDRESSED
00BD	3D		DCR A	/BY HL INTO E, INCREMENT HL AND PUT
00BE	C2 B8 00		JNZ LOOP1	/SECOND BYTE INTO D; PUSH DE, INCREMENT
00C1	C5		PUSH B	/HL, DECREMENT A AND CHECK FOR ZERO;
00C2	C9		RET	/IF ZERO PUSH RETURN ADDRESS AND
				/RETURN.
00C3	C1	RETRV	POP B	/THIS SUBROUTINE POPS TWO-BYTE WORDS
00C4	D1	LOOP3	POP D	/FROM CB STACK AND RETURNS THEM TO MEMORY.
00C5	72		MOV M,D	/NO. OF BYTE PAIRS IS DETERMINED BY A:
00C6	2B		DCX H	/SAVE RETURN ADDRESS IN BC, THEN POP
00C7	73		MOV M,E	/FIRST BYTE PAIR INTO DE; MOVE BYTE IN D
00C8	2B		DCX H	/TO MEMORY LOCATION ADDRESSED BY HL, DE-
00C9	3D		DCR A	/CREMENT HL AND MOVE BYTE IN E TO MEMORY;
00CA	C2 C4 00		JNZ LOOP3	/DECREMENT HL AND A; IF A IS ZERO, PUSH
00CD	C5		PUSH B	/RETURN ADDRESS AND RETURN.
00CE	C9		RET	
00E0	3E FD	INIT	MVI A,0FDH	/THIS SUBROUTINE PERFORMS INITIALIZATION:
00E2	D3 0A		OUT 10	/OUTPUT MASK WORD TO DISABLE UNWANTED
00E4	21 00 01		LXI H,0100H	/INTERRUPTS (NOTE: THE ACTUAL MASK WORD
00E7	36 02		MVI M,02H	/AND OUTPUT PORT ARE SYSTEM DEPENDENT.
00E9	23		INX H	/CHECK YOUR SYSTEM MANUAL FOR DETAILS).
00EA	36 01		MVI M,01H	/INITIALIZE MEMORY POINTER AT LOCATION
00EC	FB		EI	/0100H, LOAD MEMORY POINTER, LOW BYTE
00ED	C9		RET	/FIRST, THEN ENABLE INTERRUPTS AND
		PSW	EQU 6	/RETURN.
		SP	EQU 5	

Table 5. Assembly-language programming and machine code for full interrupt service

string since that will cover the highly probable situation where a double-digit page number might be used.

The most convenient way to store the information to be saved is to use the CB stack pointer and push the information onto the stack. This will limit the number of times that an in-

terrupt service can itself be interrupted, since 46 bytes of information must be saved, yet only 200 bytes of stack space are provided by CB. However, if the interrupt service does not include a lot of nested CALLs or GOSUBs, the limitation is not a problem.

The BASIC programming

necessary to service interrupts is shown in Table 4. The diagram in Fig. 3 shows the relationship between the BASIC programming and the assembly-language programming shown in Table 5. The program on memory page 4 can be anything, including a routine to load the machine code as in the previous

example. The sequence is started by executing a call to the subroutine 'INIT', shown in Table 5, which enables the interrupts and initializes the memory pointer, which is discussed in the next paragraph (in this case, 'INIT' is located at %0060). The interrupt handler on memory page 6 must end with a call to the subroutine 'REPL', also shown in Table 5, which in this example is located at %0096. Anything after the CALL %0096 will not be executed since the subroutine 'REPL' moves the stack pointer and loses (on purpose) the return address.

The assembly-language subroutine 'LOAD' and the string 'STR' are the same as in Table 3

and therefore not shown, but the subroutines 'SAVE' and 'REPL' have been added, and the subroutine 'INIT' has been extended. The address of the jump command at %0008 has been changed so that interrupt service will start with the SAVE routine, which pushes the register contents, program variables and part of the existing command onto the stack. It then uses a memory pointer, initialized by 'INIT', to determine where to store the stack-pointer address. The memory pointer allows the program to keep track of more than one stack pointer address in case the interrupt service is interrupted before it is finished. It always points to the location

in memory where the next stack-pointer address is going to be stored.

The 'REPL' routine performs the reverse of the 'SAVE' routine. It recovers the last stack-pointer address stored and moves the CB stack pointer to begin retrieving the necessary information. When the RET is executed, the program that was executing at the time of interrupt is reentered.

The location of the assembly-language interrupt service is entirely arbitrary with the exception that the JMP SAVE command must be located at the point to which control is transferred when an interrupt is received (in our case, location

%0008). The interrupt service can be stored in PROM, provided that the memory pointer, which is changed during each service, is stored in RAM.

Give It a Try

All of the methods of handling interrupts outlined in this article have been tested and proved satisfactory. Any of the three can provide a new dimension to your real-time programming if you are willing to take the time to understand your interpreter. So if you think your application requires it, give it a try. All you need is a source listing for your interpreter and the information in this article. It is well worth the effort. ■



recording studio

CENTURI is offering professional duplicating services. We serve in small or large quantities starting as low as \$1.75 each.

Fast Dependable Service.

✓C170

Call (305) 753-7440 or write to Centuri Recording Studios at 11460 West Sample Road, Coral Springs, Florida 33065.

MAXELL®
OR SCOTCH® BRAND DISKS

Some computerists pay less but may not get Shugart® or IBM® approved disks.

8" SINGLE SIDE - DOUBLE DENSITY
Box of 10 FOR \$50.00

8" DOUBLE SIDE - DOUBLE DENSITY
Box of 10 FOR \$65.00

5 1/4" MINI — Box of 10 FOR \$40.00

NEW DYSAN® DISKS **VISA**
Master Charge

5 1/4" Mini - Box of 5 for \$25.00

COD \$1.00 Additional — Specify (8" - Soft or Hard Sector) (5" - Soft or Hard Sector)

CUSTOM ELECTRONICS INC.
238 EXCHANGE STREET
CHICOPEE, MASS. 01013

EST. 1960 1-413-592-4761 ✓C132

HOURS: Tues. to Sat. — 9 to 5

• ATARI • TI/99 • 4 • MATELL •

CLOSE OUT KIM BUS 8K RAM

The famous HDE 8K RAM now on sale at the incredible price of \$155.00—quantity one. Two or more—\$150.00. Hurry while supply lasts.

THE LOGIC STORE
P.O. Box 1712, Auburn AL 36830
Call Toll Free 1-800-633-8724
regular phone number (205) 745-7735
✓L25

Here an **APPLE**
There an **APPLE**
Everywhere an **APPLE!**
APPLE!

AND GET A LOAD OF THIS DEAL!
WITH EVERY PURCHASE OF AN **APPLE II-16K**
\$1195.00
at
We will sell you an **ADDITIONAL 32K* of Memory**
for the incredible low price of **\$99.95**

MASTER CHARGE & VISA ACCEPTED
COMPUTER CORNER OF NEW JERSEY
439 Rt. 23, Pompton Plains, N.J. 07444
✓C64
CALL TODAY (201) 835-7080
*PRIME TESTED MEMORY CHIPS

PET PERIPHERALS

(FOR OTHER IEEE 486 BUS COMPUTERS, TOO)

NEW — RS-232 INTERFACE: \$229

The TNW-2000 Bidirectional Serial Interface allows keyboard input as well as printer output. The unit provides selectable automatic PET/ASCII character conversion, "bottled" output, baud rate adjustable from 110 to 9600 bits per second. \$229 price includes power supply, cabinet, PET/IEEE cable, built-in female EIA connector, full documentation. (For software controllable RS-232 control lines, and multiple RS-232 devices, TNW offers the TNW488/232 Serial Interface. Price is \$335, includes power supply, cabinet, PET cable, full documentation.)

MODEM

The TNW488/103 Low Speed Modem is Bell 103 compatible, provides auto originate/answer/dial capabilities, 75 to 600 bits per second. Interfaces to phone system via DAA. Price of \$385 includes power supply, cabinet, cables to PET and DAA, full documentation and software.

(The Net Works is now)



TNW Corporation ✓T58

Ask your dealer or contact —
ASTRONICS • (714) 278-5441
3351 Hancock St. • San Diego CA 92110

WE WILL NOT BE UNDERSOLD!!!

Find the best price you can in this magazine on a box of 10, 5 1/4" Verbatim diskettes and

**Subtract
50¢**

(Low discount price — \$26.50)

THAT'S OUR PRICE



**Alpha
Byte
Storage** ✓A101

4636 Park Granada 159
Calabasas California
91302 (213) 662-1670

*Offer good 'till December 31, 1979, as long as supply lasts. Price includes shipping in the US except for Alaska & Hawaii.

LET YOUR
TRS-80
or
H-8 SYSTEM
EARN MONEY FOR YOU.

WE SELL a complete package of programs, detailed instructions, custom forms and program manuals.

YOU SELL computer billing and record keeping to organizations conducting "Jog-a-thons." Your competition sells at 20% to 25% of gross receipts. You can do a better job for less and make excellent profits.

THE JOG-A-THON 80/8 SYSTEM

- Disk programs, manuals, forms **\$229.00**
- Manual (cost deductible on system purchase) **\$ 29.00**
- Write or call for full details

SYSTEM REQUIREMENTS — A TRS-80 (32K/Dual Drives) or the **H-8** (40K/Dual Drives) plus a 132 column printer.



3667 MONTALVO WAY
SANTA BARBARA, CA 93105
TELEPHONE (805) 682-1270

FOR THE STAMP COLLECTOR

- The ideal tool for philatelists with medium to large collections.
- Special attention given to make data entry and corrections fast and easy. Keeps your information current and accurate.
- Screens your collection for any single, or group of, characteristics.
- Provides a variety of pre-designed and user selected reports to CRT or printer. Reports are sorted on any combination of stamp characteristics. A report of catalog numbers not in collection also included.
- One thousand stamps per Data disk with Multi-disk processing for the large collection. Summary data on totals per country, value, or special categories included in Multi-disk capabilities.

SYSTEM REQUIREMENTS — A TRS-80 (32K/Dual Disks), or **H-8** (40K/Dual Disks-MBasic) and printer (64 or more characters/line)

STAMPS 80/8 \$34.95

✓ D81

✓ VISA

✓ M/C

SUPERPASCAL

5-10 times faster...
and more!

Meet Pascal/Z™ the fast, flexible compiler with higher speed, greater efficiency and improved debugging.

■ **True Z-80 native code Pascal compiler** — 5-10X faster than competing P-code implementations — *no interpreter required.*

■ **The only multi-tasking Pascal** — produces ROMable re-entrant code.

■ **Optimized for fastest execution** — recognizes and exploits special cases.

■ **Easily transportable** — all hooks to your system made through support library.

■ **Includes IEEE standard floating point package.**

Single copy on CP/M-compatible disk includes compiler, companion macro-assembler & source of the library, \$275. OEM licenses available. Write or call for more information.

InterSystems™

Ithaca Intersystems Inc., 1650 Hanshaw Road/PO. Box 91,
Ithaca, NY 14850/607-257-0190/TWX: 510255 4346

© 1979 Ithaca Intersystems Inc.

Introducing...

MAYDAY™

The Uninterruptable Power Supply



Mr. Bytes lost his program due to power failure.
Don't lose yours - Protect your time and investment.

For price list and detailed specifications, contact your nearest Sun-Technology distributor or call direct to:



Sun - Technology, Inc.

Box 210

New Durham, New Hampshire 03855

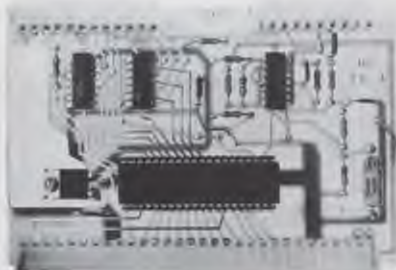
(Manufacturing high technology products since 1970)

✓ S126

(603) 859-7110



SUPPORTING
6800
COMPUTERS



High Performance Cassette Interface

- **FAST** - 4800 Baud Loads 4K in 8 Seconds!
- **RELIABLE** - Error Rate Less Than 1 in 10⁶ Bytes.
- **CONVENIENT** - Plugs Directly Into The SWTPC.
- **PLUS** - A Fully Buffered 8 Bit Output Port Provided.
- **LOW COST** - \$49.95 For Complete Kit.

- **OPTIONAL** - CFM/3 File Manager.
Manual & Listing \$19.95
(For Cassette Add) \$ 6.95

TERMS: CASH, MC or VISA; Shipping & Handling \$2.00

JPC PRODUCTS CO. J12
P.O. Box 5615, Albuquerque, N. M. 87185
Order Phone (505) 294-4623

6809!

MD-690 b Single Board Computer

- 1K RAM
- 10K PROM space
- Parallel keyboard input
- Memory-mapped video firmware
- Fully S-100 compatible (including 8080 type I/O)
- MONBUG II monitor included
- 2400 baud cassette interface
- 20 I/O lines
- RS-232 level shifters
- Real time clock
- DMA
- 6809

\$299 Assembled

\$239 Kit

Please rush me the following...

MicroDasys P.O. BOX 36051, LOS ANGELES, CA 90036, USA

☐ CPU Card (Kit) ☐ CPU Card (Assembled)

NAME _____ Exp. Date: _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Calif. residents add 6%

Kilobaud Microcomputing Subscribers

NOTE
to

From time to time Kilobaud Microcomputing makes its subscriber lists available to carefully-screened companies and organizations whose products, services or information may be of interest to you. In every case, we must approve all organizations wishing to mail to our subscribers. In every case they receive a list of names and addresses only—no other information we may have is divulged. Each organization may use the list only once and agrees never to make any personal or telephone solicitations from it.

The overwhelming majority of our subscribers appreciate this controlled use of our mailing lists—it helps them shop conveniently by mail for products and services they need, often at substantial savings. A few people prefer their names not be used. It is to them we address this message.

If you do not wish to be a part of this service, please complete the form below... your name will not be used in this manner for any reason.

(If you asked us in the past to remove your name from our lists, there is no need to repeat the request.) Please allow about six weeks for your request to take effect.

- ☐ I wish to have my name removed from the list of subscribers receiving mail other than the regular subscription to Kilobaud Microcomputing.

Mr. _____
Mrs. _____
Send to: Ms. _____ Please Print
Address _____
City _____ State _____ Zip _____

Mail this form with your mailing label from the latest issue (or fill out the information as it appears on the label) to:

Kilobaud Microcomputing
Subscription Services Dept.
P.O. Box 997
Farmingdale NY 11737

ATTENTION TRS-80* OWNERS

At last! An attractive home for all of the parts of your system—keyboard, video display, power supply, and, last but not least, the cassette. The TRS-80* performs as a computer—Now it can look like one.



Classic black and silver color scheme to match your TRS-80*. Now your system can be portable without dismantling. The cassette recorder can easily be used along side the case and then conveniently stored in the side opening without disconnecting.

Send check or money order for \$69.50 plus \$5.00 for shipping to:

Designco

Dept. 1A
P.O. Box 307
Union MI 49130
616-641-5956

Michigan residents add 4% sales tax. Visa and MC accepted with signature, exp. date, and number.

*TRS-80 is a Product of Radio Shack

✓ D47



for . . .

OHIO SCIENTIFIC

just released . . .

Problem Solver: Makes complex decisions based on your criteria. You can't be without it.

Cash Flo: Every item can have a six-point growth curve—All other cash flow packages are now obsolete.

Numerology: At last, SPD makes this accurate tool of the occult available to you. (Source book \$10)

The Tool Box: Modules in a series of tools for specific business problems . . .

Real Pak 1: Real estate investment property analysis. Built for pros. Gives you the "hammer" in any deal.

Baccus 1: MDMS compatible or stand alone invoicing and order entry module. We can't be without it.

\$30 Disk \$15 Tape (limited versions)
Specify 8" or 5", C1 or C2. Or, Send \$2 for full-line documentation package

STRUCTURED PROGRAM DESIGNERS
371 Broome St., NY, NY 10013



✓ S128



—Professional—

Real Estate Programs

available on cassette or diskette

for Apple & TRS-80 II

Property Management System

- Rental Income Tracking
- Complete Expense Analysis

System w/Manual \$125.00

Manual \$10.00

Program Modules:

- 1) Home Purchase Analysis
- 2) Income Property Cashflow/ Leverage
- 3) Construction Cost/ Profit
- 4) Tax Deferred Exchange
- 5) APR Loan Analysis

Price Per Module \$20.00

Add \$5.00 for Programs
on Diskette



At Computer Stores
everywhere or call

(213) 372-9419

for C.O.D. ✓ R33

2045 Manhattan Ave., Hermosa Beach, CA 90254

SAVE \$

Pre-Holiday Special

Dual Disk Drives!. Quad Disk Drives! IN ONE CASE!

One switch, one cord. • Over 400 K* in one (QUAD) Cabinet.

★ **Dual Drives \$698.00** Includes Cable & TRS D.O.S.

★ **Quad Drives \$1359.00** Includes Cable & TRS D.O.S.

You would pay \$1,000.00 or \$2,000.00 at Radio Shacks Prices.

90 Day EXCHANGE GUARANTEE

DEALER INQUIRIES INVITED

Send for our NEW FALL/WINTER CATA-

LOG. Ask about our LOW PRICES on 77

Track Drives. ✓ L19

*All drives will access 40 tracks when
with

NEWDOS or NEWDOS+ (EXTRA)

LEVEL IV PRODUCTS, INC.

OUTSIDE MICHIGAN CALL:
1-800-521-3305

32238 Schoolcraft, Suite F4 Livonia, Michigan 48154 (313) 525-6200

11 A.M. to 7 P.M. Tuesday - Saturday

TRS-80 Utility Package

MLUP-1 (Machine-Language Utility Package No. 1) is a single cassette containing six new machine-language routines for TRS-80s that use TRSDOS 2.1 or 2.2, Apparat's NEWDOS or a cassette recorder. Three identical versions of the package—16K, 32K and 48K—are contained on one cassette. It is programmed for both TRS-80 Level II and Disk BASIC. Hardware requirements include at least 16K of RAM.

MLUP-1 eliminates keybounce, performs a formatted input routine, permits upward and downward scrolling and provides convenient insert and delete options. The keyboard debounce/repeat gives the user an auto-repeat option and lets him ignore the BREAK key, if he wants to. The input routine establishes a protected input field on the video

screen and lets the user specify field length and location, numeric or string input mode and reduces GIGO because the numeric mode ignores everything except valid numeric characters. Price is \$25.

Disco-Tech, PO Box 11129, Santa Rosa CA 95406. Reader Service number D69.

Translator Program

SOFTRAN, a translator program from Percom Data Company, 211 N. Kirby, Garland TX 75042, converts files on soft-sectored minidiskettes for use with Percom LFD-400 hard-sectored minidisk drive systems. The program is available for mini FLEX, FLEX 2.0 and SSB DOS.

SOFTRAN makes the LFD-400 a universal minidisk storage system; minidiskette programs from all of the principal 6800 software



The SOFTRAN translator program.

suppliers may be used with the LFD-400. It copies soft-sectored minidiskettes track for track onto hard-sectored minidiskettes. If the minidiskette includes a FLEX or SSB DOS, the DOS is modified to function with the LFD-400.

Translation of mini FLEX and SSB DOS minidiskettes results in more than 10 percent additional storage space becoming available than required for the soft-sectored version. Price is \$24.95. Reader Service number P83.

CHECKBOOK II Personal Checking Account Manager

From
The Bottom Shelf
Atlanta GA

This program provides the TRS-80 user with the necessary functions to interact with today's sometimes frustrating banking system. CHECKBOOK II loads using the SYSTEM command into a 16K or 32K tape-based system or 32K or greater disk-based system. The 16K tape system allows up to 75 transactions in memory at once; the 32K allows 350; while the 32K disk allows 150 with DOS. The user is initially prompted with the program's ten-option main menu:

1. Keyboard Input
2. List and Edit
3. Print with Balance
4. Search and Total
5. Reconcile
6. Sort
7. Input from Tape (or Disk)
8. Output to Tape (or Disk)
9. Check File Length
10. Clear (and Kill on Disk)

The first option is used for entry of check data. Each entry has five fields: five digits for check numbers, six digits for the date, sixteen characters for a description, seven digits for amount and four additional characters to code each transaction by type. Input of checks does not have to be in order by check number; checks are automatically sorted by check number upon completion of keyboard input.

Listing the data gives the user a chance to review the figures from any point in the file as well as edit out any mistakes. Edit mode allows modification of individual fields or deletion of entire records.

Once the user is satisfied that the information is correct, he may select the Print with Balance option. The user is prompted for the number of the first check to be displayed and the balance of the account. This balance need only be entered the first time the program is used; the balance is automatically updated and recalled during subse-

quent sessions. The screen listing given by this module provides the balance as a result of each withdrawal and deposit beginning with the check number specified. Thus, the user can clearly see just where the account went into the negatives.

Option 4 gives the user the ability to locate all checks with common fields, for example, to total all the checks made out to the same person or recall all checks for the same commodity (indicated by the four character type code). My only complaint is the inability to search by a given amount. For instance, to recall the purpose of that \$48 check you wrote last July, you would have to scan the records manually for checks written in that time period and for that amount.

Options 7, 8 and 9 are the file-manipulation options for either disk- or cassette-based systems. Files are stored with titles indicating the check numbers contained in that particular file. CHECK FILE LENGTH tells the user how many more transactions can be added to the current file.

RECONCILE is the final operation during a session with the CHECKBOOK. In this module the user is prompted to indicate cleared checks; the program then checks the balance against the bank's monthly statement, lists outstanding checks and permanently removes cleared checks from the active file. SORT will be used if the entries are out of order.

Finally, at any point in the program that the user is being prompted for an alphanumeric input, pressing P will send whatever is on the screen to the user's printer. Make sure that the printer is connected before you try this, as all will be lost if nothing is on the printer port.

CHECKBOOK II has more than its versatile features going for it; the program flow during an operating session is logically structured, and errors are correctable before the user gets too deeply in trouble. The graphics listings are very readable, using a column format perfect for permanent records. Instead of restricting the user to one particular sequence, this program allows the user to act freely, making CHECKBOOK II the best of its kind so far and a valuable tool for use in personal banking.

Kevin Cohan
Micro Lab, ISI

Heath CP/M

The basic CP/M package for the Heathkit H17 and H89 disk system includes text editor, assembler, debugger and other system utilities plus six users' manuals. It operates directly with systems configured for HDOS. Most programs designed to run under CP/M will be available to operate with this system, including Microsoft BASIC, FORTRAN and COBOL. Price is \$145.

Lifeboat Associates, 2248 Broadway, New York NY 10024.

Software

Math Library I: This 22-program package, written in Level II

BASIC (TRS-80) and Release 4 BASIC (North Star), contains elementary methods for solving scientific problems. Suitable for educators, engineers, consultants and other professionals who want to apply microcomputers in solving real-world problems. TRS-80 disk (DOS 2.1) is \$35; North Star disk (single density) is \$45. Dr. Lee, 5819 Thomas Ave., Philadelphia PA 19143. Reader Service number L3.

Textwriter: Text-formatting program to print personalized form letters, reports and manuals, contracts and specifications or books and articles. Available for \$125 on all commonly used floppy disk media in versions for use with CP/M and other similar systems. Organic Software, 1492 Windsor Way, Livermore CA 94550. Reader Service number O14.

Individual Study Center: Self-teaching educational course with subject matter for grade-school or high-school students (Puzzler, House on Fire, Around the Ball Park), as well as for adults who want to review history, French, spelling or novice ham license, etc. The four-cassette package for the TRS-80 Level II or Apple II costs \$39.94, plus \$1.50 postage and handling. TYC Software, 40 Stuyvesant Manor, Geneseo NY 14454. Reader Service number T69.

Tax-Deferred Exchange Model: Shows the total financial impact—considering appreciation, depreciation, legal fees, improvements, mortgages, etc.—of a tax-deferred or partially tax-deferred property exchange. Cassette is \$20 and diskette is \$25 for the Apple II and TRS-80 Level II. Realty Software Com-

pany, 2045 Manhattan Ave., Hermosa Beach CA 90254. Reader Service number R33.

TIS Software: Three new software packages for the Commodore PET/CBM:

Checkbook program—assists in balancing a checkbook, selects and displays checks by person, purpose or date and sums checks by category or person.

Accounts program—creates a data base for company names, addresses, invoice and purchase order numbers and amounts of purchase.

Calendar program—enables you to keep track of appointments in the office, schedule social engagements, etc.

Each cassette costs \$9.90; floppy disk is \$12.95. Total Information Services, PO Box 921, Los Alamos NM 87544. Reader Service number T75.

Some Dos and Don'ts for writers and wirers.

Do write about business and educational applications.

We'd like to see more articles on the use of microcomputers in business applications. If you have a useful piece of business software, by all means write it up for *Kilobaud Microcomputing*. There's also a need for reviews of business systems. Businessmen want to know which hardware items work well

together—with a minimum of hassle—and what a computer can do for them.

Educational programs are going to be BIG. If your kids are happily learning math, spelling or any other subject with the aid of your micro, please share your programs with the rest of us.

Do write in English—not computerese.

One thing: Please try hard to use as few buzzwords as possible. Remember that *Kilobaud Microcomputing* is trying to bootstrap newcomers into this field, not scare them away. If you understand your subject, you shouldn't have to be obscure.

Do send a manuscript—not an illegible printout.

Use regular typing paper (not the erasable type) and double-space your manuscript, leaving wide margins. Number the pages when you put your name on each page. Do not type titles, subtitles or text in all capitals. Manuscripts that are single-spaced and/or typed in all caps will automatically be returned for revision. Underlining a word indicates that it is to be in italics. Keep a carbon copy . . . just in case. Send us the original. Each page of typed copy will be equal to about one-sixth of a page in *Kilobaud Microcomputing*.

Do stick to the point; don't throw in extraneous, irrelevant material.

Generating an outline of your proposed article is perhaps one of the most important steps you can take (as well as, of course, sticking to it and not getting sidetracked).

Use active rather than passive voice. "I fastened the nut" is better than "the nut was fastened." Write in short, concise sentences, starting a new paragraph with each new thought.

Avoid unnecessary abbreviations and capitalizations. Use subheadings for each new section to provide signposts for the readers.

Don't make it look like a PhD thesis.

Avoid footnotes, if possible, and just put your references in the text (it's easier to read that way). And don't forget to give credit when you borrow an idea from someone else. This is important both ethically and legally.



Don't solder in the bathtub.

Do keep figures and text separate.

Put all drawings on separate sheets of paper—never in the text. We have excellent draftsmen who redraw all diagrams and schematics, so be sure that your sketches are complete, neat and readable. Put parts values on the schematic rather than in a separate parts list. Use terms "IC1," "R1" and "C2," etc., only if you are referring to them in the text. If a block diagram

will be helpful in getting the "big picture," then by all means include one. Label all drawings as Fig. 1, Fig. 2 and so on. Be sure to sequentially reference figures in the text. Write a caption for each and include this with the article text so our typesetters will be able to set the type. Put your name and page number on every sheet of paper you submit.

Don't submit programs scrawled in crayon on grocery bags.

Important: All programs submitted to *Kilobaud Microcomputing* must be in a camera-ready condition. This means that programs should be a printout (single-spaced) and not typed. If you don't have a printer, borrow one. Programs may be typed as a last resort, but they must be single-spaced and legible. (Type carefully to avoid having to make corrections; use a carbon, rather than a fabric, ribbon.) Don't print programs on newsprint, colored paper or lined paper. Use white paper only.

WE WILL NOT BE UNDERSOLD!!!

Find the best price you can in this magazine on a box of 10, 5 1/4" Verbatim diskettes and

**Subtract
50¢**

(Low discount price - \$25.50)
THAT'S OUR PRICE



**Alpha
Byte
Storage** ✓ A101

4536 Park Granada 159
Calabasas California
91302 (213) 992-1970

*Offer good 'till December 31, 1979, as long as supply lasts. Price includes shipping in the US except for Alaska & Hawaii.

apple computer OR TEXAS INSTRUMENTS 99/4 HOME COMPUTER FOR

\$999.00

INTEGRAL DATA
IP-440 Paper Tiger, List \$995. \$895
Apple Disk II w/controller. \$520
DC Hayes Modem. \$335



**YOUR OWN COMPUTER
LTD.** ✓ Y3

10678 CAMPUS WAY SOUTH

LARGO, MD 20870 - (301) 350-6680

Datapoint CRT Terminals



**Fully-Assembled — Guaranteed
#3360 \$649.50**

- Add \$15 packing
- Shipped FOB Washington, D.C. Terms check, M.O. or charge.
- 90-day guarantee
- Scrolling version \$895.00
- Model 3360 speeds from 300-4800 Baud, numeric keypad, cursor controls, Edit, Block-Transmit, search modes, ASCII Keyboard with codeable options. Green phosphor, 24 80 ch lines, addressable cursor, RS-232C serial interface, other speeds available. Manual \$10, cable kit \$9.95. Datashare/IBM-2260 compatible version \$1,100.00 • Model 3000 \$495.00. M-33 ASR Teletype \$895, KSR \$725; All M-28, 35 components available also. Modems, readers, QUANTITY DISCOUNTS AVAILABLE. Leasing, service at low prices.

TELECOMMUNICATIONS SERVICES CO.

Box 4117, Alexandria, Va. 22303 ✓ T26
703-683-4019 / TLX 89-623

Yes!

You Can Have
Your PET™ And
Counter Too.



D & R 2nd-Cassette System FEATURES:

- Sanyo Recorder M2545A.
- Digital Counter.
- Audio Location of Programs.
- Cuing feature allows you to Audibly locate programs in fast forward speeds.
- Includes Interface Module and all Plugs & Cables.
- \$83.00 Check or Money Order
- Add \$3.00 For Shipping And Handling, Canada (U.S. Funds)
- \$6.00 S & H. Michigan 4% Tax

DEALERS WRITE

Personal Computer System
ATARI 800 \$895.00
Disc Drive & Printer Available
Write for more information and prices.

CREATIVE SYSTEMS
P.O. BOX 402K ✓ O71
ST. CLAIR SHORES, MI
48080

22 MHz MONITORS!

**NEW
\$99**



**12 INCH
GRAPHICS
QUALITY**

SOLID STATE 22 MHz MONITORS: OEM labelless style, B&W 14" CRT. Accepts separate video and TTL level horiz. & vert. syncs. Any sweep 10-20 KHz, 110 VAC. Simple TRS-80 hookup. Supurb resolution, bandwidth 10 Hz-22 MHz. With full front manual, timing, schematics, TRS-80 hookup, parts list. Used, fully checked, very clean, no burns \$77. New, checked: \$99

TOUCHTONE DECODERS: Talmor/Corbin 7940-01, single 12V DIP contains complete analog timing. Corbin digital counter type 18 time decoder. Hook up to 12V & 3.58 MHz color burst, full audio in, get 2 nt's or 4-64 Hz out. Current OEM list price is \$120. Brand new w/crystal & full manual. \$66

9-100 CORE SALE: Brand new, Intel Ampex core. See article "IT'S TIME FOR CORE" (8/29 KiloByte p. 34) which describes a simple interface between this core and an S-100 machine. But ignore the prices in the article! Sale price, including documentation pkg. and schematics 10K \$230 BK \$99

AMPEX 29 MEGABYTE DISK DRIVES: Brand new commercial 20 surface disk drives at a fraction of their OEM cost. Model DM312, full size console type units, 25 MHz data rate with the best written technical manual we've ever seen. If you enjoy interface design this is the bargain you've been waiting for! \$1600

TERMS: UPS included except DM312. SAME or call for full spec sheets on any item. UPS COD welcome, add \$1.25 VISA & MC rates. NJ add sales tax. Everything guaranteed, immediate shipment or immediate refund. Phone orders and questions are welcome.

ELECTRAVALUE INDUSTRIAL
P.O. BOX 157-K
MORRIS PLAINS, NJ 07960

Phone orders
are welcome.
201/267-1117

SMALL BUSINESS COMPUTER SERVICE

We offer for the Micropolls Mod II

Accounts Receivable	\$150.00
Accounts Payable	150.00
General Ledger	150.00
Investment Package	35.00
Assembly Language Course	35.00
Family Package	30.00
Tiny Pascal	45.00

We offer for the TRS-80 Level II on tape

Tiny Pascal	45.00
Assembly Language Course	35.00
Family Package	30.00

(Illinois Residents add 5% sales Tax)

**SMALL
BUSINESS
COMPUTER
SERVICE** ✓ S95

813 MacArthur Drive
Urbana, IL 61801
217-367-7806

Considering a computerized
Christmas?
Then go for OSI!

I:O POWER

THE C4PMF
December Deals

Buy a Challenger IP at \$349
or a Challenger 4P at \$898
and receive 4K static RAM free!!
(\$70 value)

Similar savings on other OSI products



✓ C171

51591 US 31 N
South Bend IN 46637
(219) 277-4655

MICROPHASE SYSTEMS

Announces

WORDMASTER for TRS-80's

Let WORDMASTER transform your Model I or Model II TRS-80 into a high quality word processing system.

WORDMASTER features include: full screen editing, margin justification, line insertion, line deletion, block move, block copy, find, change and much much more.

Model II	\$149.95
req. 1 disk, 64k mem.	
Model I disk version	\$ 99.95
req. 1 disk, 48k mem.	
Documentation only	\$ 9.95
(can be applied to later purchase)	

STOCK MARKET DATA TAPES for TRS-80 Model I II

Each tape cassette contains one months data for the NYSE or AMEX stock of your choice. Data includes daily high, low, close, and volume information. Can be read by any Level II Basic program with simple input statements. Available for Jan. 1979 to present. Please specify month and stock name.

one months data	\$ 5.95
charting program	\$49.95
(plots high, low, close and 2 moving avgs.)	

MicroPhase Systems
11223 E. 45 St. So. #314 ✓ M125
Tulsa, Ok. 74145

TRS-80 has a HOME



INTRODUCING:
Custom furniture for the
TRS-80 office or home decor.

Featuring

- Custom all wood, hand rubbed, walnut finish.
- Builds-in complete TRS-80 business system.
- Provides copy shelf, drawer, and cushion arm rest.

— FOR 24 HOUR INFORMATION —
PHONE 408-946-1265

AVS
✓ A115

AUDIO-VIDEO 3485 AUTUMNVILLE AVE.
SYSTEMS SAN JOSE, CA. 95122

**NEECO**

Microcomputer Systems Division

**PROUDLY ANNOUNCES THE NEWEST
HARDWARE AND SOFTWARE FOR YOUR PET!**

The PET is now a truly sophisticated
Business System with the announcement
of these peripherals and software packages.



PRODUCT	DESCRIPTION	PRICE	AVAILABILITY
PET 2001—8KN (Large Keys)	8K RAM	\$ 795	IMMEDIATE
PET 2001—8K	8K RAM	\$ 795	IMMEDIATE
PET 2001—16KN (Large Keys)	16K RAM*	\$ 995	IMMEDIATE
PET 2001—32KN (Large Keys)	32K RAM	\$1295	IMMEDIATE
PET 2023 PRINTER	ROLL FEED	\$ 850	IMMEDIATE
PET 2022 PRINTER	TRACTOR/ROLL	\$ 995	IMMEDIATE
ROMRETRO KIT	UPDATED O/S	\$ 90	IMMEDIATE
PET 2040	DUAL FLOPPY*	\$1295	IMMEDIATE
PET C2N	2nd Cassette	\$ 100	IMMEDIATE

*The 16K/32K (large keyboard) units do not include a cassette drive. Order C2N Cassette.
2040 Floppy Drive requires a 16K or 32K unit. 8K RAM Retrofit available July.

ALL PETS ARE FULLY TESTED BY NEECO BEFORE SHIPMENT. NEECO IS A
FULL CUSTOMER-ORIENTED BUSINESS. CALL FOR OUR FREE CATALOG.
SEND US A COPY OF THIS AD WITH AN ORDER AND WE WILL WARRANTEE
YOUR COMMODORE PET FOR ONE FULL YEAR!

PET-DISK BASED BUSINESS SOFTWARE

SOFTWARE/APPLICATION	REQUIRES	AUTHOR	AVAILABILITY	PRICE
WORDPRO II / WORD PROCESSING	2040 + 16K PET	PRO/MICRO	IMMEDIATE	\$100
WORDPRO III / WORD PROCESSING	2040 + 32K PET	PRO/MICRO	DECEMBER	\$200
GENERAL LEDGER	2040 + 32K PET	CMS SOFTWARE	IMMEDIATE	\$295*
ACCOUNTS PAYABLE	2040 + 32K PET	CMS SOFTWARE	DECEMBER	\$295*
ACCOUNTS RECEIVABLE	2040 + 32K PET	CMS SOFTWARE	DECEMBER	\$295*
MAILING LIST	2040 + 32K PET	CMS SOFTWARE	IMMEDIATE	\$100
NEECOLEDGER	COMPUTHINK .4	NEECO	IMMEDIATE	\$795
	M DRIVE + 32K PET			
NEECOMAILER	COMPUTHINK .4	NEECO	IMMEDIATE	\$150
	M DRIVE + 32K PET			

*The CMS Software (G/L, A/R, A/P) are based on Osborne & Associates trial tested business basic software.
Software is complete with full documentation and user instructions. All packages require a printer for output.
Commodore recommends the NEC Spinwriter (available from NEECO) as the output printer for WORDPRO.

DEALER INQUIRIES INVITED ON SOFTWARE & NEC (PET) SPINWRITER**FOR WORD PROCESSING
NEC IS BEST!**

- * 55 characters per second output speed
- * Changeable thimble for different typesizes
- * Less than 1% warranty malfunction rate
- * IBM quality letter output
- * Dealer inquiries invited

THE NEC SPINWRITER
MODEL 5530-P (Centronics I/O
modified for PET)

\$2995

*Price includes IEEE interface
to PET. IEEE Port is available
for use with 2040 Dual Disk.

*The NEC 5530-P is the output printer recommended by Commodore for their Word Processing System.



Microcomputer Systems Division

N12

NEECO

NEW ENGLAND ELECTRONICS CO., INC.
679 HIGHLAND AVE., NEEDHAM, MASS. 02194
SHOWROOM HRS.: MON. - FRI. 9:30 - 5:30, EST.

(617) 449-1760

MASTERCARD OR VISA ACCEPTED
TELEX NUMBER 951021, NEECO

CAT-100 GETS COLOR!

Complete on two S-100 boards, CAT-100 is the original 16-color imaging system with high resolution video frame grabber.

FREE CATALOG request yours today **Stock.**



Digital Video Systems Dept. 32 595 Matadero Avenue Palo Alto, CA 94306 415/494-6008

VIDEO MONITORS FREE CASSETTE RECORDERS

With **SORCERER** by Exidy

Z80 Processor
Full-size ASCII Keyboard
Calculator Style Numeric Pad
8K RAM (up to 48K RAM)
Resident 4K Monitor ROM
Interchangeable ROM Paks

Dual Cassette I/O
Serial and Parallel I/O
30 x 64 Character Display
240 x 512 Graphics Resolution
64 User Definable Characters
S-100 Compatible

	New List Price
with 8K RAM Receive FREE Cassette Recorder	Value \$67
with 16K RAM Receive FREE 12" Video Monitor	Value \$149
with 32K RAM Receive FREE Monitor and Recorder	Value \$216
with 48K RAM Receive FREE Monitor and Recorder PLUS Extended BASIC	Value \$265

WE PAY ALL SHIPPING AND HANDLING CHARGES.
Shipment stock to 30 days. Connecticut residents please add 7% sales tax.

MICRO DISCOUNT SERVICE
198 General Lyon Rd., Eastford, CT 06242
203-974-1214

HOW TO START YOUR OWN SYSTEMS HOUSE

A practical guide for the small EDP entrepreneur. 213-page manual covers all aspects of starting and successfully operating a Small Business Computer company. 5th revised edition June 1979. From the contents:

- The Systems House Industry • Hardware, Software or Both? • Market Selection & Evaluation • Industry Application Opportunities • Equipment Selection • Becoming a Distributor • Product Pricing • Getting Your Advertising Dollars Worth • The Selling Cycle • Financing For The Customer • Questions You Will Have To Answer Before The Customer Buys • Solving The Service Problem • Protecting Your Product • How To Write A Good Business Plan • Raising Capital

Send \$36.00 (check, VISA or Mastercard) to:

Essex Publishing Co., Dept 1
285 Bloomfield Avenue
Caldwell, N.J. 07006

Credit card orders: Send card #, date exp. Add \$2.00 for rush, air mail shipping. N.J. residents add 5% sales tax. For faster shipment on credit card orders, phone (201) 783-6940.

TRS-80 NEEDS FILLED

TM TRS-80 is a trademark of Radio Shack, a division of Tandy Corp.

- *Disk drives—plug and run
Shugart 35 or MPI 40 track @ \$319 & Micropolis 77 track @ \$570 4-drive cable @ \$34 P.P. (box of 10) disks @ \$27.50 P.P. in hrd. case \$31 P.P.
- *Printers—Harris Selectric typewriter (refurbished) & cables & TRS232 @ \$790—new Centronics—779 tractor @ \$950 & CENT. 730 @ \$820—cable for \$34 P.P.
- *Professional business software—mail list & Library 100 @ \$75—letter secretary or job cost @ \$240 ea.—Interact inventory control with B.O.M. @ \$299 Osborne Interact A/R, A/P, & G/L @ \$350—P/R @ \$125—All P.P.
- *Power drops & outages? System boot out? Lose data? —Get Mayday UPS (uninterruptible power supply) from \$195—write
- *MA, residents, add 5% tax** P.P. means postpaid conf. U.S.A.. All else F.O.B. Tewksbury ** M/C, VISA, or check.

OMNITEK SYSTEMS

24 Marcia Jean Dr., Dept. M
Tewksbury MA 01876
Tel. 617-851-3156

12" BLACK & WHITE LOW COST VIDEO TERMINAL

Easily interfaced with Radio Shack TRS 80

\$149.00 LIST

Will sell 6 feet coaxial cable \$5.00
Add \$5 for shipping and handling in Continental U.S.A.



One year limited warranty

- * Ideal for home, personal and business computer systems: surveillance monitors • 12" diagonal video monitor • Composite video input • Compatible with many computer systems • Solid-state circuitry for a stable & sharp picture • Video bandwidth—12 MHz ±3 dB • Input impedance—75 Ohms • Resolution—630 lines Minimum 1H Central 80% of CRT; 550 Lines Minimum beyond central 80% of CRT ref EIA RS-375 • Dimensions—11.375" high; 16.250" wide; 11.250" deep (exclude video input connector) • Weight—6.5 KG (14.3 lbs) net

Use Master Charge/Visa or send money order.

Micro Products Unlimited

P.O. Box 1525, Arlington, TX 76010
817/461-8043
Dealer inquiries welcome

DATA-BASE MANAGEMENT

- INITIALIZATION: of any data base by no. of records, no. of fields, name of fields, no. of characters per field.
- SELECTIVE LISTING: on any field.
- MENU DRIVEN: for easy operation, addition, lookup, change, delete, list.
- HASHING: for fast operation on large files.
- FREE! APPLICATION: mailing list generator with multi-key selective listing.

NORTH STAR: DISK	\$29.95
TRS-80: DISK OR CASSETTE	\$29.95
LISTINGS: FOR ABOVE	\$20.00

Computer Data Services

P.O. Box 1626, Melbourne FL 32935

MICROPOLIS

Generalized Accounting Software

The GENERAL LEDGER provides multiple chart of accounts capability, user defined reporting, multi-level summarization and many large mainframe features. For additional information on the GENERAL LEDGER or other accounting software, write to:

Management Information Specialists
4823 South 25th Street
Milwaukee, Wisconsin 53221

M121

CI-68A CONTROL INTERFACE



- 8 opto-isolated inputs
- 8 reed relay outputs
- Relay status register
- /IRQ and /NMI jumper selectable
- Complete documentation
- \$79.95 kit
- \$95.00 assembled and tested

AD-68A ANALOG-TO-DIGITAL CONVERTER



- 8 Analog inputs (0-2.5V)
- Single ramp, software driven conversion
- 8bit, 9.6 ms maximum
- Complete documentation
- \$39.95 assembled and tested

For SWTPC 6800 type computer. Write for more information.

Terms: US and Canada add 5% shipping. Others add 15% US funds only. TX residents add 5% tax. VISA and MC ok.

INNOVATIVE TECHNOLOGY
510 Oxford Park • Garland, TX 75043 • (214) 270-8393

ANNOUNCING & COMPUPRISM?

CHECK THIS LITTLE MUTANT OUT !!!

Single board color graphics interface for S-100 bus systems
16K on board memory!
16 colors always available!
27648 individual picture elements!
Every element programmable in any color at any time!
Sequential memory mapping makes programming easy!
KIT \$240.00 ASSEMBLED \$280.00

4 MHz MOD FOR S.D. SYSTEMS
EXPANDORAM \$10
16 CHANNEL A-D, 8 CHANNEL D-A
FOR S-100 BUS, BARE BOARD WITH DOCUMENTATION \$25

J.E.S. GRAPHICS
P.O. BOX 2752
TULSA, OK. 74101
(918) 742-7104



RONDURE COMPANY

2522 BUTLER ST.
DALLAS, TEXAS 75235
214-630-4621

the computer room

SPECIAL

Printer for your Microcomputer



GE TERMINET 300 PRINTER

Pin feed—9" paper

- 80 Print positions
- Receive only
- ASCII code
- RS-232 interface
- 30 CPS
- Upper & lowercase
- Shipping wt. 75#

Shipping containers \$15.00.

(used)

(good working condition)

Will run on serial RS232 port of most
micros including TRS-80.

\$450.00

DATEL SELECTRIC (IBM Selectric Mechanism) ASCII SELECTRIC



Printer Mechanism: Heavy duty
input/output, Series 745.
Weight: 120 lbs. Dimensions: 29"
H x 35" W x 33" D.

Print Speed (10 characters per
second)
Platen: 15" wide, pin feed or form
feed device optional (132 print
positions).

Parallel output only 10 characters
per second accepts 7 bit ASCII
parallel w/strobe & prints on
Selectric. The unit still works as a
typewriter in off-line mode.

\$995.00

TESTED WITH
NEW
ASCII
ELECTRONICS

ASCII Selectric with ASCII parallel electronics.



ASCII Keyboard

(used)

with enclosure

SALE \$25.00

New RS232 Connectors



Male—3.50
Female—4.50
Covers—1.75

WE HAVE FLAT-PACK ACOUSTIC



Modem pickup

\$19.50



USED FANS

Muffin—8.00
Sprite—4.00

MICRO SWITCH KEYBOARD



USED BUT LOOKS VERY NICE

\$40.00

(WITH PRINT)

USED POWER SUPPLY \$15.00



V 5, 16.5, 6, -3
A 12, 6, 2, 1



NEW CAT MODEM

195.00



ORIG.
ONLY
95.00

USED OMNITEK



USED MI²

ANS/ORIG.
149.00



NEW POWER SUPPLY 25.00

V 5, 12, -12
A 3, 6, 3

ORDERING INFORMATION:

We ship the same day we receive a certified check or money order.
Texas residents add 5% sales tax. Please call if you have a question.
Write for our CATALOG of many parts, terminals, printers, etc.
All items subject to availability. Your money returned if we are out
of stock.

SHIPPING INFORMATION:

Modems: \$2.00 each; 2 for \$4.00 UPS.
Large Items & Parts: Specify Freight or Air Freight Collect.
Foreign Orders: Add appropriate freight or postage.
We now take Master Charge and Visa orders. Specify full number,
bank number and expiration date.

USED PRINTERS

SUPER "SELECTRIC" ONE

"Selectric" Line Printer. **Receive Only** (no edit). ASCII-Centronics Parallel Input. **BUILDING BLOCK PRINTING**. Line Storage Buffer. Page Programming. 6000A CPU. **Our Price** 135.50. **110** x 110 inch. 10" Carriage. Interface with ALL Mini & Micro Computers. Packed with extra! OEM Modified "SELECTRIC". Worth a fortune! Our "SELECTRIC ONE" comes with complete data. ***\$60.00**

SUPER "SELECTRIC" ONE-A

Same as the "Selectric One" but also has X-Y Plotter capability. 1/60 of an inch increments. 1000 lines. Carriage & Plotter. Plotting Applications. 10" wide by approx. 50 pages long. Nothing else like it in the world. ***\$300.00**

CENTRONICS 102A

BiDirectional Line Printer featuring 3x7 Dot Matrix. Auto Shiftoff. 300 characters per second. 132 columns. Standard Centronics Parallel Input. **TRIS-80** COM. **PARALLEL**. Dual Print Heads. 125 Lines/Minute & much more. ***\$65.00** (tested and functional)

I/O "SELECTRIC"

KSR-type with 15" Carriage. IBM Heavy Duty Model 705. complete I/O Encoding & Decoding (Solenoids & Microswitches). Works as a typewriter (A&T) and index solenoids need +28 VDCI. **EXCELLENCE** Removed from WORD PROCESSORS. takes standard IBM type elements. upper & lower housings included. 110 VAC operation. Good condition. includes I/O data & info. **Only \$395.00**

RECEIVE-ONLY "SELECTRIC"

Reagan-printed IBM Model 1980 R.O. "Selectric" Printer. Upper case. 11" Carriage. **PRINTED PLATEN** (takes letter paper). Standard Tilt & Rotate Encoding—Standard Solenoid Configuration. NO Keyboard (Printer-Only). Takes most "SELECTRIC" type elements. Used. as-is. from Airline Reservation Systems. Ideal for use with TRS-80 level 1. ***\$119.00 ea.** Buy 2 and SAVE! **2/\$219.95**

"TWIX" SELECTRIC

KSR Matched with "twix-type" keyboard. telephone line compatible. 11" Carriage. **Printed Platen**. IBM Model 705 Heavy Duty Printer. Also includes I/O "Black Box" with RS-232 Circuitry and Internal MODEM. Ready to connect to the phone line (includes 4-prong phone plug I/O). As used with "TELEX" or "TWIX" to transmit & receive typed messages over phone wires. As-is. removed from Airline Reservation Systems. Made by ICOT. **SPECIAL PRICE** **Only \$499.00**

PRINTER SOUND HOOD

Built by Gates, the Sound People. 34" wide. 21" long and 12" High. Fits over Selectric "IN-THE-DESK" type printers like 2741, MT/ST, our I/O SELECTRICS and others. Quiescent operation by as much as 30 dB. Features hinged Plexiglas front cover and keyboard door. Item used. holes for platen knobs. Only slightly used. Orig. cost over \$200.00. Now Only ***\$25.50 ea.**

THE FINE PRINT:

Not additive to printer cost. there's a \$17.50 charge (\$30.00 for the Centronics) for the shipping crate (the R.O. Selectric Model 1980 and sound hood require no crate). We ship all printers by TRUCK. FOR our services, except Sound Hood & Model 1980 which are shipped via UPS, whenever possible.

*Payment must be received and collected before we can ship. When your Printer arrives, you must pay for the delivery "C.O.D."

*Unless otherwise specified, all Printers are sold on an "as-is, first come, first serve" basis. Though we take great care to ensure that each machine is shipped clean, whole and usable.

*Mastercharge & VISA accepted. *Telephone orders welcome!

*IBM Trademark



CFR Associates, Inc.
Newton, N.H. 03858

(603)382-5179 ✓C160

Write or Call for our Special PRINTER FLYER

DELTRONIKS

1. EMM 4200A, 4K Static RAMs, Ceramic
A local memory boards manufacturer closed. We bought the new memory boards and took these 4200A static RAMs out. They are tested and 90-day guaranteed 100% good.

Prime tested 4200A 4K RAMs \$5.50 ea.,
32/\$160.00, 300 pieces or more \$4.50 ea.

2. Static RAMs MK4104 4KX1 (350 nS)
Ltd. Qty. **\$4.00 ea.**

3. Power SCR's (GEC50A) 100 volt @ 110 amps. **\$6.95 ea.**

4. Squirrel Cage Fans (Howard). \$7.00 ea.

5. Power Diode 1N1202A, 200 volt @ 12 amp. **4 for \$1.00**

6. LM 323 5 Volt 3 amps, voltage regulator 4.95 each or 10/\$45.00.

7. Super Saver, Micro PD411, Ceramic 4K x 1 dynamic RAMs. **8 for \$10.00.**



DELTRONIKS
PO BOX 29363 ✓D28
ATLANTA, GA 30359

Save more than 20%!

AMERICAN SQUARE COMPUTERS

NORTH STAR--INTERTUBE THINKER TOYS--MICROTEK

The smartest computers at the smartest price.



HORIZON QUAD & DOUBLE DENSITY

	LIST	ONLY
HORIZON-1-32K-D-KIT	\$1999	\$1585
HORIZON-2-32K-D-KIT	\$2399	\$1905
ASSEMBLED & TESTED	\$2765	\$2195
HORIZON-2-32K-KIT QUAD	\$2799	\$2225
ASSEMBLED & TESTED	\$3215	\$2555
PASCAL FOR NORTH STAR ON DISK		49
POWERFUL NORTH STAR BASIC		FREE
TEI PT 212 COMPUTER 5 MHz	8000	6250
THINKER TOYS DISCUS/2 A&T	1149	949
DISCUS/2 + 2 1.2 MEGABYTES A&T	1549	1299
MEASUREMENT SYSTEM MEMORY A&T 4 MHz 64K	640	
GODBOUT MEMORY		CALL FOR PRICE



INTERTUBE II SMART TERMINAL **\$995 \$745**



MICROTEK PRINTER **750 675**
ANADIX PRINTER **995 875**
FLORIDA DATA PRINTER 600 CPS **4300 CALL FOR PRICE**

Super Software at Reasonable Prices

MARYELLEN WORD PROCESSOR	YOUR BEST BUY	\$38
TEXTWRITER III		\$125
EZ-80 TUTORIAL—LEARN MACHINE LANGUAGE		\$25
PDS FOR NORTH STAR—BETTER THAN CP/M		\$99
COMPILER FOR HORIZON—SECRET SUPERFAST CODE		\$100

10% Off Software Prices with Computers

VERBATIM THE BEST DISKETTES	BOX OF 10	\$29
WHICH COMPUTERS ARE BEST? BROCHURE		FREE
NORTH STAR DOCUMENTATION, REFUNDABLE WITH COMPUTER		\$20



AMERICAN SQUARE COMPUTERS
✓A65

KIVETT DR
JAMESTOWN NC
27282
(919) 883-1105

CFR Associates, Inc.

Newton, N.H. 03858

A MILESTONE PRINTER OFFER!!!

DIABLO "Hytype" Daisy Wheel KSR TERMINALS



These used, cleaned and refurbished Daisy Wheel Terminals feature the FAMED DIABLO "HYTYPE" Daisy Wheel Printer with its multitude of capabilities. Includes 1/60" horiz. & 1/48" vertical spacing in the "PLOT" mode.

Limited Offer — Special Price

Only \$1750.00 WHILE THEY LAST!!!

We Also Offer Many Types of "SELECTRIC"™ Printers: ASR, RO and More.

For Example:
Receive only, BCD Coded "Selectric" with Pinfeed Platen and Data. As-is, used Model 1980
Only \$109.00 each!!

*Trademark of International Business Machines

Write or Call for our Special
PRINTER FLYER ✓C150
(603)382-5179

- Mastercharge and VISA accepted
- Phone Orders Are Welcome
- Prices may not include shipping & handling

PRINTERS.....PRINTERS.....

T-BUG™ USER:

Super TLEGS: Onboard relocater for T-BUG, moves T-BUG to any desired RAM location. Now examine, modify, # P punch backup copies of formerly coincident program material, experiment with parallel kustom T-BUGs. Also will relocate TSTEP.
16K Level II Super TLEGS No. LL 0 **9.95**

TSTEP: Single-stepper for T-BUG. Displays all CPU aspects related to instruction set as you SPACE through ROM or RAM. Indispensable for debugging, analyzing alien program material or learning Z-80.

- a) CPU registers in before/after # R-like format, user accessible, independent of T-BUG registers.
- b) Testable flag status in before/after format.
- c) Top stack elements in before/after format.
- d) 13 key Implicit Keypad. Backspace, CLEAR, more.

Subroutines can be single-stepped or run directly, control remaining with TSTEP. Also, Super TLEGS will relocate TSTEP, making monitor and single-stepper into an independently relocatable unit. Confirm any code by seeing what you are imagining.
16K Level II TSTEP No. LL 1 **11.95**

EMU 02: Software emulation of the 6502 microprocessor. T-BUG displays byte, EMU takes it from there. Now you can write, debug, execute 6502 programs on your TRS-80!

- a) Disassembler posts standard 6502 Assembly mnemonic next to T-BUG displayed byte, in scrolling field.
- b) Single-stepper displays 6502 Processor Model in before/after form, expanded flag and stack elements, all updated after each instruction is SPACE-ed.
- c) 4-speed TRACE mode animates 6502 Models, activates keyboard scan port accessible to 6502 instructions.
- d) Fast interpretive RUN mode for realistic execution.
- e) 13 key Implicit Keypad. Backspace, Relspace, more.

How to have a 6502 without having a 6502! Compare and contrast. Work in a powerful programming language that is distinct from BASIC, Z-80. Read Apple, PET code.
16K Level II EMU 02 No. BL 1 **\$24.95**

75 mailing each program, CA add 6%
ALLEN GELDER
Box 11721 Main Post Office
San Francisco, CA 94101

T-BUG, TRS-80™ Radio Shack/Tandy Corp. ✓G34

Save \$ on TRS-80 Products

Send for **FREE**
Catalog

NEW!! TREMENDOUS SAVINGS ON TRS-80 SYSTEMS

Complete system includes:
TRS-80 Level II, w/our 48K RAM, Dual MPI
Disk Drives, and the APPARAT DOS+ soft-
ware (\$2500 value), only \$2049. Line printer
and desk options available.

SUPERDISK

TF-7D Micropolis Largest capacity
mini floppy, up to 195 Kbytes
on 77 tracks with 77TK DOS+ \$699



**A Complete Family
Of Disk Drives
To Choose
From . . .
In Stock**

TF-1	Pertec FD200, 5 1/4", 40 track use both sides	\$379
TF-3	Shugart SA400, 5 1/4", 35 tracks same as sandy	\$389
TF-5	MPI 5 1/4" 40 track door lock and auto diskette ejection	\$379
TDH-1	Pertec Dual Head mini-floppy 35 track same capacity as 2 drives	\$499

All disk drive systems come complete with power supply and
chassis

• Two drive cable= \$25 • Four drive cable= \$35

PRINTERS PRINTERS PRINTERS PRINTERS

LP779 Centronics 779	\$1099
w/tractors	
LP700 Centronics 700	\$1175
LP701 Centronics 701	\$1759
NEC Spinwriter	\$2499



CENTRONICS 703

LP702 Centronics 702	\$1899
LP703 Centronics	\$2540
LP1 Centronics P1	\$ 399
Centronics cables	\$ 39

Add-on Disk Drives

DOES NOT INCLUDE POWER SUPPLY OR CHASSIS

• Pertec FD200 or MPI B-52	\$272.00
• Shugart SA400 (unused)	\$282.00
• Pertec Dual Head	\$399.00

NEW PRODUCTS

• Small System RS232 Interface	\$ 49.00
• Expansion Interface w/32K	\$499.00
• AC Line Interference Eliminator	\$ 18.95
• AC Isolator (6 connectors)	\$ 45.95
• Telephone Interface	\$179.95
• Verbatim 5" soft sector Diskettes	\$ 3.39

IMPROVE TRS-80 PERFORMANCE WITH NEWDOS+

Over 200 modifications,
corrections and enhance-
ments to TRS DOS.
Includes utilities. Available in
two versions:
35 Track version \$99
40 Track version \$110



All prices cash discounted.
Freight FOB/Factory

Memory

16KM 16K RAM Kit
Computer \$74
Expansion Interface \$78

Software

• Accounts Receivable	\$39
• Inventory Control	\$39
• Job Entry/Status	\$75
• General Ledger	\$79
• Game Diskette	\$19
• AJA Word Processor	\$75



**MICROCOMPUTER
TECHNOLOGY
INCORPORATED**

2080 South Grand Ave.
Santa Ana, CA 92705
(714) 979-9923



6000 E. Evans Ave., Bldg. 2
Denver, CO 80222
(303) 758-7275

pparat, Inc.

Radio Shack — Your No. 1 Parts Place™

Low Prices and New Items Every Day!

Low-Power Schottky ICs

Low As **49¢**

- 100% Prime
- Guaranteed Specs

Improved 5-volt logic devices use Schottky diode technology for minimum propagation delay and high speed at minimum power.

Type	Cat. No.	ONLY
74LS00	276-1900	.49
74LS02	276-1902	.59
74LS04	276-1904	.59
74LS08	276-1908	.49
74LS10	276-1910	.59
74LS13	276-1911	.99
74LS20	276-1912	.59
74LS27	276-1913	.99
74LS30	276-1914	.59
74LS32	276-1915	.69
74LS47	276-1916	1.29
74LS51	276-1917	.59
74LS73	276-1918	.69
74LS74	276-1919	.69
74LS75	276-1920	.99
74LS76	276-1921	.79
74LS95	276-1922	1.29
74LS90	276-1923	.99
74LS92	276-1924	.99
74LS93	276-1925	.99
74LS123	276-1926	1.19
74LS132	276-1927	.99
74LS151	276-1929	.99
74LS157	276-1930	1.19
74LS181	276-1931	1.49
74LS164	276-1932	1.49
74LS175	276-1934	1.19
74LS192	276-1935	1.49
74LS193	276-1936	1.49
74LS194	276-1937	1.49
74LS198	276-1938	1.59
74LS367	276-1939	1.19
74LS368	276-1940	1.19
74LS373	276-1943	2.39
74LS374	276-1944	2.39

4000-Series CMOS ICs

Type	Cat. No.	EACH
4001	276-2401	.69
4011	276-2411	.69
4012	276-2412	.79
4013	276-2413	.99
4017	276-2417	1.69
4020	276-2420	1.69
4021	276-2421	1.69
4023	276-2423	.69
4027	276-2427	.99
4028	276-2428	1.29
4046	276-2446	1.69
4511	276-2447	1.69
4049	276-2449	.79
4050	276-2450	.79
4051	276-2451	1.49
4066	276-2466	1.39
4070	276-2470	.79
4518	276-2490	1.49
4543	276-2491	1.99

All Prime from Major Semiconductor Manufacturers. Specs and Pin Out Diagram Included with Each Device.

MC14553 3-Digit BCD Counter IC

2.99

CMOS chip replaces over 8 separate ICs in a digital display circuit. Input pulse shaping. Master reset pin. 16-pin DIP. 276-2498 2.99

RAM Memory ICs

Low As **2.49**

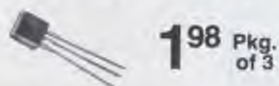
2102 1024 x 1 Array. Low-cost static memory chip. 16-pin DIP. Buy 8 and save! 276-2501 2.49 Ea. or 8/14.95
2114L 1024 x 4 Array. NMOS static RAM. 18-pin DIP. 276-2504 10.99

NEW! Silicon Solar Cells



Convert light to electrical power. All deliver 0.45V at rated current. Use several in series/parallel for higher voltages or current.
276-122. 1/2" 3" cell. Rated 500 mA 5.99
276-123. Full 3" cell. Rated 1 amp 8.99

Hall-Effect Sensors



1.98 Pkg. of 3
Open-Collector Output
Detects magnetic fields electronically. 750 gauss "on" threshold. Constant amplitude independent of frequency. Similar to type ULN 3006. Ideal for tachs, position sensing, pulse counting. 5 to 16V supply. TO-92 case. With data. 276-1646 Pkg. of 3/1.98

Unique LEDs



Tri-Color. Displays red, green, yellow. Uniform light output of 0.6 mcd. Forward voltage: 2.2VDC. Max. current: 25mA. T1-94 case style. 276-035 1.39
Red Flasher. Operates directly from 5VDC power source. Pulse rate: 3 Hz. Max. current: 20 mA at 5VDC. 276-036 1.29

NEW! Switches



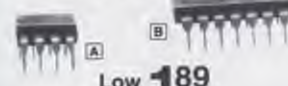
Submini Push Switches. One red, one black. SPST momentary contacts rated 0.5A, 125VAC. Normally open. 275-1571 Pkg. 2/1.69
Compact Lever Switches. 6A at 125VAC. SPST. 275-257 2.49
DPDT. 275-259 2.99

NEW! BNC Connectors



Type 1094 Female BNC. Mounts in single 3/4" hole. 278-105 1.49
Type UG-88 Male BNC. No soldering! Screws onto standard coax cable. Plated finish. For RG-58/U Cable. 278-103 2.19
For RG-59/U Cable. 278-104 2.19

BIFET Op Amps



Feature very high input impedance, low noise. Fast 13V/μs slew rate is ideal for low TIM distortion audio amplifiers. Internally compensated. Up to ±18V supply.
LF 353N. Dual BIFET Op amp. 8-pin DIP. 276-1715 1.89
TL 084C. Quad BIFET Op amp. 14-pin DIP. 276-1714 2.99

SN-76477 "Music Synthesizer" IC



2.99
Creates almost any type of sound! High level op amp output. Includes 2 VCOs, low frequency osc., noise generator, filter, 2 mixers, timing logic. 28-pin DIP. With data. 276-1765 2.99

LED Bar/Dot Display Driver



LM3914N. Features 10 adjustable analog steps, bar or dot display mode. Current-regulated LED outputs. 8 to 25VDC supply. 18-pin DIP. 276-1707 3.49
LM3915N. As above but with 3 dB log steps. 276-1708 3.49

AC and DC Relays



SPST Solid State AC Relay. Handles 24 to 280VAC at up to 1.5A. TTL compatible. 5VDC control input. 1500Vrms isolation. 275-236 1.99
12VDC SPDT. Silver-plated contacts. 1A at 125VAC. 275-231 2.49

Manufacturer's Data Books



Low As **2.95**

Need Info? — Find it at Radio Shack!

- Motorola RF Data Manual.** Power and small-signal RF transistors, hybrid amplifier modules, more. 62-1380 4.95
- Motorola Low-Power Schottky TTL.** Data and diagrams plus selection guide for choosing best device. 62-1381 3.95
- Linear Applications, Vol. 2.** Latest data, diagrams, applications briefs and articles. Indexed. 62-1374 2.95
- CMOS Integrated Circuits.** Covers 74C, CD4000-series with complete data, diagrams. Cross referenced. 62-1375 3.95
- Memory Data Book.** Complete info on MOS and bipolar memory components, support circuits. 62-1376 3.95

4" Cooling Fan

12.95

Super Quiet Operation



Ideal for cooling power supplies, microcomputers, hi-fi and Ham gear. Delivers up to 70 CFM. Diecast venturi. U.L. recognized motor. For 120VAC, 60 Hz. 273-241 12.95

12/24-Hr. LCD Clock Module

19.95



24-Hour Alarm Shows Time/Day/Date
Complete clock module — just add switches and battery! 0.25" LCD display has built-in backlight, alarm set, PM and snooze indicators. Operates up to a year on single 1.5V battery. Accuracy: ±13 seconds per month. 277-1005 19.95

WHY WAIT FOR MAIL ORDER DELIVERY? IN STOCK NOW AT OUR STORE NEAR YOU!

Radio Shack®

A DIVISION OF TANDY CORPORATION • FORT WORTH, TEXAS 76102
OVER 7000 LOCATIONS IN 40 COUNTRIES

COMPUCRUISE

Put a computer in your car, which gives you the most effective and functional cruise control ever designed, plus complete trip computing, fuel management systems, and a remarkable accurate quartz crystal time system.

So simple a child can operate, the new CompuCruise combines latest computer technology with state-of-the-art reliability in a package which will not likely be available on new cars for years to come. • Cruise Control • Time, E.T., Lap Timer, Alarm • Time, Distance, Fuel to Arrival • Time, Distance, Fuel to Empty • Time, Distance and Fuel on Trip • Current or Average MPG, GPH • Fuel Used, Distance since Fillup • Current and Average Vehicle Speed • Inside, Outside or Coolant Temperature • Battery Voltage • English or Metric Display. \$199.95 without cruise control \$159.95.



FLOPPY DISK STORAGE BINDER

This black vinyl three-ring binder comes with ten transparent plastic sleeves which accommodate either twenty, five-inch or ten, eight-inch floppy disks. The plastic sleeves may be ordered separately and added as needed. A contents file is included with each sleeve for easy identification and organizing. Binder & 10 holders \$14.95 Part No. B800; Extra holders 95¢ each. Part No. 800



OPTO-ISOLATED PARALLEL INPUT BOARD FOR APPLE II

There are 8 inputs that can be driven from TTL logic or any 5 volt source. The circuit board can be plugged into any of the 8 sockets of your Apple II. It has a 16 pin socket for standard dip ribbon cable connection. Board only \$15.00. Part No. 120, with parts \$69.95. Part No. 120A.



TIDMA

• Tape Interface Direct Memory Access • Record and play programs without bootstrap loader (no prom) has FSK encoder/decoder for direct connections to low cost recorder at 1200 baud rate, and direct connections for inputs and outputs to a digital recorder at any baud rate • S-100 bus compatible • Board only \$35.00 Part No. 112, with parts \$110 Part No. 112A



SYSTEM MONITOR

8080, 8085, or Z-80 System monitor for use with the TIDMA board. There is no need for the front panel. Complete with documentation \$12.95.

16K EPROM

Uses 2708 EPROMs, memory speed selection provided, addressable anywhere in 65K of memory, can be shadowed in 4K increments. Board only \$24.95 part no. 7802, with parts less EPROMs \$49.95 part no. 7902A.



ASCII KEYBOARD

TTL & DTL compatible • Full 67 key array • Full 128 character ASCII output • Positive logic with outputs resting low • Data Strobe • Five user-definable spare keys • Standard 22 pin dual card edge connector • Requires +5VDC, 325 mA. Assembled & Tested. Cherry Pro Part No. P70-05AB. \$119.95.



ASCII KEYBOARD

53 Keys popular ASR-33 format • Rugged G-10 P.C. Board • Tri-mode MOS encoding • Two-Key Rollover • MOS/DTL/TTL Compatible • Upper Case lockout • Data and Strobe inversion option • Three User Definable Keys • Low contact bounce • Selectable Parity • Custom Keycaps • George Risk Model 753. Requires +5, -12 volts. \$59.95 Kit.

ASCII TO CORRESPONDENCE CODE CONVERTER

This bidirectional board is a direct replacement for the board inside the Trendata 1000 terminal. The on board connector provides RS-232 serial in and out. Sold only as an assembled and tested unit for \$229.95. Part No. TA 1000C

DISK JACKET™

Made from heavy duty .0095 matte plastic with reinforced grommets. The mini-diskette version holds two 5-1/4 inch diskettes and will fit any standard three ring binder. The pockets to the left of the diskette can be used for listing the contents of the disk. Please order only in multiples of ten. \$9.95/10 Pack.



ATARI 800

Computer with 8K \$995.00, disk drive \$549.00, printer \$599.99



VIDEO TERMINAL

16 lines, 64 columns • Upper and lower case • 5x7 dot matrix • Serial RS-232 in and out with TTL parallel keyboard input • On board baud rate generator 75, 110, 150, 300, 600, & 1200 jumper selectable • Memory 1024 characters (7-21L02) • Video processor chip SFF96364 by Neculonic • Control characters (CR, LF, etc., etc.) • Non destructive cursor: CS, home, CL • White characters on black background or vice-versa • With the addition of a keyboard, video monitor or TV set with TV interface (part no. 107A) and power supply this is a complete stand alone terminal • also S-100 compatible • requires +16, & -16 VDC at 100mA, and 8VDC at 1A. Part No. 1000A \$199.95 kit.



RS-232/20mA INTERFACE

This board has two passive, opto-isolated circuits. One converts RS-232 to 20mA, the other converts 20mA to RS-232. All connections go to a 10 pin edge connector. Requires +12 and -12 volts. Board only \$9.95, part no. 7901, with parts \$14.95 Part No. 7901A.



COMPUCOLOR II

Model 3, 8K \$13.95, Model 4, 16K \$15.95, Model 5, 32K \$18.95. Prices include color monitor, computer, and one disk drive.



PET COMPUTER

With 32K & monitor - \$1195. Dual Disk Drive - \$1195.



Apple II or APPLE II PLUS

16K \$979.00



CASSETTE TAPE ERASER



REMOVES RECORDINGS IN ONE SECOND! The process eliminates static positive / negative ions and maintains original tone quality with minimal tape hiss • To improve tone quality • To reduce hissing • For quick and easy to erase • No battery or liquid required • Powerful and effective action • Unconditional 2 year guarantee. ERASER-B \$19.95.

16K RAMS

For the Apple, TRS-80 or Pet \$9 each Part No. 4116/2117.

APPLE II HOBBY/PROTOTYPING CARD

\$14.95 Part No. 7907

T.V. INTERFACE

• Converts video to AM modulated RF, Channels 2 or 3. So powerful almost no tuning is required. On board regulated power supply makes this extremely stable. Rated very highly in Doctor Dobbs' Journal. Recommended by Apple • Power required is 12 volts AC C.T., or +5 volts DC • Board only \$7.60 part No. 107, with parts \$13.50 Part No. 107A



PARALLEL TRIAC OUTPUT BOARD FOR APPLE II

This board has 8 triacs capable of switching 110 volt 6 amp loads (660 watts per channel) or a total of 5280 watts. Board only \$15.00 Part No. 210, with parts \$119.95 Part No. 210A.

To Order:

Mention part no., description, and price. In USA shipping paid by us for orders accompanied by check or money order. We accept C.O.D. orders in the U.S. only, or a VISA or Master Charge no., expiration date, signature, phone no., shipping charges will be added. CA residents add 6.5% for tax. Outside USA add 10% for air mail postage and handling. Payment must be in U.S. dollars. Dealer inquiries invited. 24 hour order line (408) 448-0800



Send for FREE Catalog... a big self-addressed envelope with 41¢ postage gets it fastest!

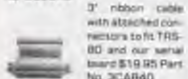
ELECTRONIC SYSTEMS Dept. KB P. O. Box 21638, San Jose, CA USA 95151

TRS-80^{ES} SERIAL I/O

- Can input into basic
- Can use LIST and LPRINT to output, or output continuously
- RS-232 compatible
- Can be used with or without the expansion bus
- On board switch selectable baud rates of 110, 150, 300, 600, 1200, 2400, parity or no parity odd or even, 5 to 8 data bits, and 1 or 2 stop bits, D.T.R. line
- Requires +5, -12 VDC
- Board only \$19.95 Part No. 8010, with parts \$59.95 Part No. 8010A, assembled \$79.95 Part No. 8010C. No connectors provided, see below.



EA/RS-232 connector Part No. 0825P \$6.00 with 9' ribbon cable with attached connectors to fit TRS-80 and our serial board \$10.95 Part No. 0825S



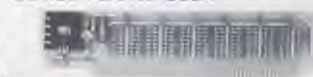
RS-232/ TTL INTERFACE

- Converts TTL to RS-232, and converts RS-232 to TTL
- Two separate circuits
- Requires -12 and +12 volts
- All connections go to a 10 pin gold plated edge connector, kit \$ 9.95 Part No. 232A 10 Pin edge connector \$3.00 Part No. 10P.



S-100 BUS ACTIVE TERMINATOR

Board only \$14.95 Part No. 900, with parts \$24.95 Part No. 900A



MODEM

- Type 103
- Full or half duplex
- Works up to 300 baud
- Originate or Answer
- No coils, only low cost components
- TTL input and output
- Connect 8 Ω speaker and crystal mic. directly to board
- Uses XR FSK demodulator
- Requires +5 volts
- Board only \$7.60 Part No. 109, with parts \$27.50 Part No. 109A



DISKETTES



Box of 10, 5" \$29.95, 8" \$39.95. Plastic box, holds 10 diskettes, 5" - \$4.50, 8" - \$6.50.

RS-232/TTY INTERFACE

This board has two active circuits, one converts RS-232 to 20mA, and the other converts 20mA to RS-232. Requires +12 and -12 volts. \$9.95 Part No. 600A Kit.



APPLE II[®] SERIAL I/O INTERFACE



Baud rate is continuously adjustable from 0 to 30,000

- Plugs into any peripheral connector
- Low current drain, RS-232 input and output
- On board switch selectable 5 to 8 data bits, 1 or 2 stop bits, and parity or no parity either odd or even
- Jumper selectable address
- SOFTWARE
- Input and Output routine from monitor or BASIC to teletype or other serial printer
- Program for using an Apple II for a video or an intelligent terminal.
- Also can output in correspondence code to interface with some electrics.
- Also watches DTR
- Board only \$15.00 Part No. 2, with parts \$42.00 Part No. 2A, assembled \$62.00 Part No. 2C

8K EPROM PICEON

Saves programs on PROM permanently (until erased via UV light) up to 8K bytes. Programs may be directly run from the program saver such as fixed routines or assemblers.

- S-100 bus compatible
- Room for 8K bytes of EPROM non-volatile memory (2708's)
- On-board PROM programming
- Address relocation of each 4K of memory to any 4K boundary within 64K
- Power on jump and reset jump option for "turnkey" systems and computers without a front panel
- Program saver software available
- Solder mask both sides
- Full silkscreen for easy assembly.
- Program saver software in 1 2708 EPROM \$25, Bare board \$35 including custom coil, board with parts but no EPROMS \$139, with 4 EPROMS \$179, with 8 EPROMS \$219.



WAMECO PRODUCTS WITH

ELECTRONIC SYSTEMS PARTS

FDC-1 FLOPPY CONTROLLER BOARD will drive shugart, pertek, remex 5" & 8" drives up to 8 drives, on board PROM with power boot up, will operate with CPM (not included) PCBD \$42.95

FPS-1 Front Panel. (Finally) IMSAI size hex displays. Byte or instruction single step. PCBD \$42.95

MEM-1A 8Kx8 fully buffered, S-100, uses 21102 type RAMS. PCBD \$24.95, \$168 Kit

QMB-12 MOTHER BOARD, 13 slot terminated, S-100 board only \$34.95, \$89.95 Kit

CPU-1 8080A Processor board S-100 with 8 level vector interrupt PCBD \$25.95, \$89.95 Kit

RTC-1 Realtime clock board. Two independent interrupts. Software programmable. PCBD \$25.95, \$60.95 Kit

EPM-1 1702A 4K EPROM card PCBD \$25.95, \$49.95 with parts less EPROMS

EPM-2 2708/2716 16K/32K EPROM card PCBD \$24.95, \$49.95 with parts less EPROMS

QMB-9 MOTHER BOARD. Short Version of QMB-12. 9 Slots PCBD \$30.95, \$67.95 Kit

MEM-2 16Kx8 Fully Buffered 2114 Board PCBD \$25.95, \$269.95 Kit

T.V. TYPEWRITER

- Stand alone TVT
- 32 char/line, 16 lines, modifications for 64 char/line included
- Parallel ASCII (TTL) input
- Video output
- 1K on board memory
- Output for computer controlled cursor
- Auto scroll
- Non-destructive cursor
- Cursor inputs: up, down, left, right, home, EOL, EOS
- Scroll up, down
- Requires +5 volts at 1.5 amps, and -12 volts at 30 mA
- All 7400, TTL chips
- Char. gen. 2513
- Upper case only
- Board only \$39.00 Part No. 106, with parts \$145.00 Part No. 106A



UART & BAUD RATE GENERATOR

- Converts serial to parallel and parallel to serial
- Low cost on board baud rate generator
- Baud rates: 110, 150, 300, 600, 1200, and 2400
- Low power drain +5 volts and -12 volts required
- TTL compatible
- All characters contain a start bit, 5 to 8 data bits, 1 or 2 stop bits, and either odd or even parity.
- All connections go to a 44 pin gold plated edge connector
- Board only \$12.00 Part No. 101, with parts \$35.00 Part No. 101A, 44 pin edge connector \$4.00 Part No. 44P



TAPE INTERFACE

- Play and record Kansas City Standard tapes
- Converts a low cost tape recorder to a digital recorder
- Works up to 1200 baud
- Digital in and out are TTL
- serial
- Output of board connects to mic. in of recorder
- Earphone of recorder connects to input on board
- No coils
- Requires +5 volts, low power drain
- Board only \$7.60 Part No. 111, with parts \$27.50 Part No. 111A



HEX ENCODED KEYBOARD

This HEX keyboard has 19 keys, 16 encoded with 3 user definable. The encoded TTL outputs, 8-4-2-1 and STROBE are debounced and available in true and complement form. Four onboard LEDs indicate the HEX code generated for each key depression. The board requires a single +5 volt supply. Board only \$15.00 Part No. HEX-3, with parts \$49.95 Part No. HEX-3A. 44 pin edge connector \$4.00 Part No. 44P.



DC POWER SUPPLY

- Board supplies a regulated +5 volts at 3 amps., +12, -12, and -5 volts at 1 amp.
- Power required is 8 volts AC at 3 amps., and 24 volts AC C.T. at 1.5 amps.
- Board only \$12.50 Part No. 6085, with parts excluding transformers \$42.50 Part No. 6085A



To Order:

Mention part no., description, and price. In USA shipping paid by us for orders accompanied by check or money order. We accept C.O.D. orders in the U.S. only, or a VISA or Master Charge no., expiration date, signature, phone no., shipping charges will be added. CA residents add 6.5% for tax. Outside USA add 10% for air mail postage and handling. Payment must be in U.S. dollars. Dealer inquiries invited. 24 hour order line (408) 448-0800



Send for FREE Catalog ... a big self-addressed envelope with 41¢ postage gets it fastest!

ELECTRONIC SYSTEMS

Dept. KB, P. O. Box 21638, San Jose, CA USA 95151

MEMORY WAR SHOP AND COMPARE

4 MHZ EXPANDORAM II KIT

The S-100 Memory Board for the 80's

SD SYSTEMS' ExpandoRAM II is a state-of-the-art dynamic RAM board with capacities from 16K bytes (4116) to 256K bytes (4164). It operates on the industry S-100 Bus. The ExpandoRAM II's design allows eight boards to operate from the same S-100 Bus. Page mode operation provides the system with the capability of servicing multiple users without RAM interference. Invisible refresh and synchronization with wait states provide greater reliability, and processing speeds up to 4 Mhz.

The ExpandoRAM II is compatible with most S-100 CPU's based on the Z80 microprocessor. When other SD SYSTEMS 200 series boards are combined with the ExpandoRAM II, they create a microcomputer with exceptional capabilities and features.

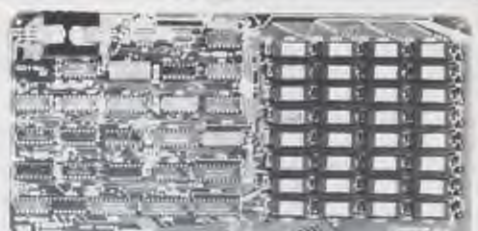
- S-100 Bus Compatible
- Up to 4Mhz Operation
- Expandable Memory from 16K to 256K
- DIP Switch Selectable Boundaries
- Uses 16K (4115) or 64K (4164) Memory Devices
- Page Mode Operation Allows up to 8 Memory Boards on Bus
- Operates with Z80 CPU's
- Phantom Output Disable
- Invisible Refresh (Synchronized with Wait States)

NEW

Sale Price

SDS - EXPANDORAM II KIT (4116)

16K	\$280.00	48K	\$450.00
32K	\$365.00	64K	\$535.00



SD EXPANDORAM The Ultimate S-100 Memory



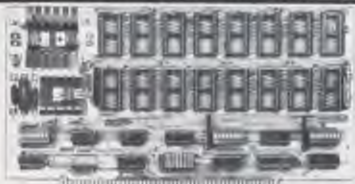
EXPANDO 64 KIT (4116)

	Reg. Price	Sale Price
16K	\$249	\$219
32K	\$324	\$285
48K	\$399	\$355
64K	\$474	\$415

The EXPANDORAM is available in versions from 16K up to 64K, so for a minimum investment you can have a memory system that will grow with your needs. This is a dynamic memory with the invisible on-board refresh, and IT WORKS!

- Interfaces with Altair, IMSAI, SOL-8, Cromenco, SBC-100, and others.
- Bank Selectable
- Phantom
- Power 8VDC, \pm 16VDC, 5 Watts
- Lowest Cost Per Bit
- Uses Popular 4116 RAMS
- PC Board is double sided solder masked and has silk-screen parts layout.
- Extensive documentation clearly written
- Complete Kit Includes all Sockets for 64K
- Memory access time: 375ns, Cycle time: 500ns.
- No wait states required
- 16K boundaries and Protection via Dip Switches
- Designed to work with Z-80, 8080, 8050 CPU's

LOOK FOR OUR HUGE AD IN JANUARY BYTE



EXPANDOPROM

The ExpandoPROM can be populated with either the 2708 (1K) or the 2716 (2K) EPROMs, and may be located on either 16K or 32K boundaries.

- S-100 Bus Compatible
- Expandable Read Only Memory from 1K to 32K
- Each EPROM is Dip Switch Selectable
- Dip Switch for Addressing on 16K/32K Boundaries
- Dip Switch Selectable Wait States
- Interfaces with Imjai, Altair, Sol-20 Cromenco and SD SYSTEMS' Z80 CPU Cards

SDS-EXPANDOPROM KIT	\$136.00
SDS-EXPANDOPROM KIT	\$210.00



Z80 CENTRAL PROCESSING UNIT

- S-100 Bus Compatible
- 2 Mhz or 4 Mhz Operation
- Power-On Jump to any 4K Boundary
- On-Board Socket for up to 2K PROM
- Front Panel Usage Optional
- Optional Wait States

The MPB-100 can upgrade an existing S-100 8080 System with little or no necessary modifications. The MPB-100 is additionally suited for some control applications. The PROM socket will accommodate a 1K or 2K PROM plus the single voltage 4K PROM.

SDS-MPB-100 KIT	\$199.00
SDS-MPB-100 A&T	\$289.00



SINGLE BOARD COMPUTER

With On-Board RAM, PROM, CTC

- S-100 Bus Compatible
- Z80 Central Processing Unit
- 1024 Bytes of Random Access Memory
- 8K Bytes of PROM using 2716
- Parallel Input and Output Ports
- Four Channel Counter/Timer (Z80-CTC)
- Software Programmable Baud Rate Generator
- No Front Panel Required for Operation

SDS-SBC-100 2MHZ KIT	\$219.00
SDS-SBC-100 2MHZ A&T	\$349.00
SDS-SBC-200 4MHZ KIT	\$259.00
SDS-SBC-200 4MHZ A&T	\$369.00

Sale Price



VDB-8024 VIDEO DISPLAY BOARD

With on-board Z80 Microprocessor

- S-100 bus Compatible
- Full 80 Characters by 24 Lines Display
- Characters Displayed by High Resolution 7 x 10 Matrix
- Composite or TTL Video Output
- Keyboard Power and Interface
- Forward and Reverse Scrolling Capability
- Blinking, Underlining, Field Reverse, Field Protect and Combinations
- Full Cursor Control
- 96 Upper and Lower Case Characters
- 32 Special Character Set
- 128 Additional User Programmable Characters (Optional)
- On-Board Z80 Microprocessor
- 2K Bytes Independent On-Board RAM Memory
- Glitch-Free Display

SDS-VDB-8024 KIT	\$315.00
SDS-VDB-8024 A&T	\$469.00



PROM-100

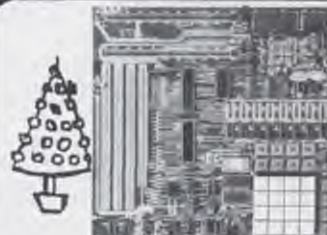
Programming Board for PROM Development

NEW

SD SYSTEMS' PROM-100 is a versatile PROM programming board offering complete EPROM programming capability. The board operates on the industry standard S-100 Bus. Support software verifies the erasure of EPROM and verifies the loaded program. SD SYSTEMS' PROM-100 offers a support-software listing with its operations manual.

- S-100 Bus Compatible
- Programs the Following EPROM's: 2708, Intel 2758, 2716, 2732 and Texas Instruments 2516
- Dip Switch Selection of EPROM type
- 25 VDC Programming Pulse Generated On Board
- Maximum Programming time: 16,384 Bits in 100 Seconds
- Power Requirement: +8VDC at 300 ma.; +16 VDC at 100 ma.; -16 VDC at 60 ma.
- TTL compatible
- Software Provides for Reading of Object File from SDOS, CP/M or PROM and Programming into EPROM
- Program Verification
- Verification of Erasure
- Zero Insertion Force Socket

SDS-PROM-100 KIT	\$149.00
SDS-PROM-100 A&T	\$219.00



Z80 STARTER KIT

A Complete Microcomputer On A Board

- Z80 CPU with 158 Instructions
- On-Board Keyboard and Display
- On-Board PROM Programmer for Single Voltage PROMS (2716, 2758, 272516)
- Kansas City Standard Cassette Interface
- Simple Key Controlled Audio Cassette Load and Dump
- Expansion Provision for Mounting Two S-100 Connectors (Sockets Not Included)
- Wire Wrap Area for Custom Circuitry
- Single Step through RAM or PROM
- Memory Examine and Change
- Port Examine and Change
- Z80 CPU Register and Change
- 2K Byte ZBUG Monitor in ROM
- 1K Bytes of RAM (Expandable to 2K Bytes)
- A 4 Channel Hardware Counter/Timer (Z80-CTC)
- Two Bi-Directional 8-Bit I/O Ports (Z80-P10)
- Up to 5 Programmable Breakpoints
- Switch Selectable PROM or Monitor Restart
- Vectored Interrupts provided by Z80-CTC and

SDS-Z80 STARTER KIT	\$219.00
SDS-Z80 STARTER A&T	\$369.00

Sale Price

PRIORITY ONE ELECTRONICS

16723 Roscoe Blvd. Sepulveda, CA 91343

Terms: Visa, MC, BAC, Check, Money Order, C.O.D. U.S. Funds Only. CA residents add 8% sales tax. Minimum order \$10.00. Prepaid U.S. orders less than \$75.00 include 5% shipping and handling. Minimum \$2.50. Excess refunded just in case - please include your phone no.

Prices subject to change without notice.

We will do our best to maintain prices thru Dec. 1979.

phone orders welcome (213) 894-8171, (800) 423-5633

OEM and institutional inquiries invited.

800-

423-5633

EXCEPT

CA, AK, HI.

(213) 894-8171

ORDER TOLL FREE 1-800-423-5633 ORDER TOLL FREE 1-800-423-5633

LOOK FOR OUR HUGE AD IN JANUARY BYTE

Memory War Shop and Compare

SPECIAL

HICKOK LX303

~~\$74.95~~

\$69.95*

before
X-mas



.5%, 3 1/2 digit 19
Range DVM, 1/2" LCD displays
runs 200 hrs on 1 battery, 10 Meg
Ohm Input, 1 yr. guarantee, made in
U.S.A., test leads included.

Available Accessories

RC-3 115V AC Adapter \$7.50
CC-3 Deluxe Padded Vinyl
Carrying Case \$7.50
VP-10 X10 DCV Probe Adapter/
Protector 10Kv \$14.95
VP-40 40Kv DC Probe \$35.00
CS-1 10 Amp Current Shunt \$14.95

***FREE**

Just for Asking.
FREE BATTERY with your meter.

RS232 & "D" TYPE CONNECTORS

P = Plug Male S = Socket Female C = Cover Hood

PART NO.	DESCRIPTION	PRICE
DE-9P	9 Pin Male	1.4 5.8 19.24
DE-9S	9 Pin Female	1.50 1.30 1.20
DE-9C	9 Pin Cover	2.15 2.05 1.95
DA15P	15 Pin Male	1.50 1.30 1.15
DA15S	15 Pin Female	2.20 2.00 1.80
DA15C	15 Pin Cover	3.20 3.00 2.80
DB-25P	25 Pin Male	1.60 1.45 1.30
DB-25S	25 Pin Female	2.90 2.80 2.50
DB1212-1	1 pc. Grey Hood	3.75 3.65 3.40
DB1225-1A	2 pc. Black Hood	1.85 1.40 1.20
DB10963-3	2 pc. Grey Hood	1.80 1.55 1.35
DC27P	37 Pin Male	3.95 3.80 3.60
DC27S	37 Pin Female	0.75 0.50 0.20
DC37C	37 Pin Cover	2.20 1.95 1.75
DO50P	50 Pin Male	4.95 4.75 4.50
DO50S	50 Pin Female	7.50 7.20 6.90
DO50C	50 Pin Cover	2.50 2.20 2.10
D25418-S	Hardware Set (2 pair)	1.00 .80 .70

Connector for CENTRONICS 700 SERIES:
Amphenol 57-30360 for back of Centronics 700 Series printers
1.4—\$9.00 5-pc—\$7.50

SALE S-100 BUS EDGE CONNECTORS • SALE

S100-WWG S100/100 Conn 125 cts. 3 LEVEL WIRE WRAP .025" sq. posts on .250 spaced rows. GOLD PLATED	S100-S10 S100/100 Conn 125 cts. DIP SOLDER TAIL on .250 spaced rows for VECTOR, IMSAI, CROMEMCO mother boards. GOLD PLATED
1-4 5.8 10.24 14.75 \$4.00 \$3.75	1-4 5.8 10.24 14.75 \$4.00 \$3.75
S100SE S100/100 Conn 125 cts. PIERCED SOLDER EYELET Tails GOLD	S100ALT S100/100 Conn 125 cts. DIP SOLDER TAIL on 140 spaced rows for ALTAIR motherboards. GOLD PLATED
1-4 5.8 10.24 14.75 \$4.00 \$3.75	1-4 5.8 10.24 14.75 \$4.00 \$3.75

Other Popular Edge Connectors

D2244-SWW D2244 Conn 156 cts. WIRE	D2244-SSE D2244 Conn 156 cts. PIERCED SOLDER EYELET Tails GOLD PLATED
1-4 5.8 10.24 14.75 \$4.00 \$3.75	1-4 5.8 10.24 14.75 \$4.00 \$3.75

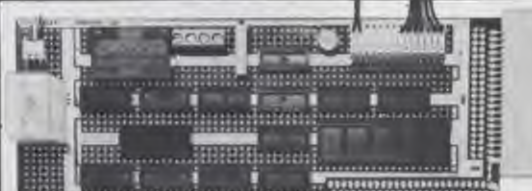
CG 1 (MSA) Style Card Guides \$51.00
See our July Ad for many other connectors.

3 LEVEL GOLD WIRE WRAP SOCKETS*

Sockets purchased in multiples of 50 per type may be combined for best price.

	1-9	10-24	25-99	100-249	250-999
8 pin	.40	.36	.34	.31	.27
14 pin	.44	.43	.41	.39	.37
16 pin	.55	.47	.45	.41	.39
18 pin	.70	.60	.55	.50	.45
20 pin	.90	.80	.75	.65	.62
22 pin	.95	.85	.80	.70	.65
24 pin	.95	.85	.80	.70	.65
28 pin	1.25	1.15	1.00	.95	.90
40 pin	1.85	1.45	1.35	1.20	1.10

All sockets are GOLD 3 level closed entry. 2 level Tail Low
Profile. Tin Sockets and Dip Plugs available. CALL FOR QUOTATION.



APPLE PLUGBOARD

Vector 4609 Peripheral Interface Plugboard for construction of custom circuits
Plug compatible with Apple II, Commodore PET and Super Kim microcomputers.
Three connectors, in addition to the standard 35/50 system bus, are available for
input/output. A 20/40-contact card-edge connector, fabricated in the rear of the
board, mates with a 3-M type ribbon connector. Alternatively, a right-angle
solder-tail header may be positioned in this same location. The Model 4609 also
accommodates the miniature SIP-type connectors which may be placed on the
periphery or in mid-board.

1-4	5.8	10.24
\$21.50	\$19.36	\$17.26

7520 APPLE EXTENDER CARD \$24.95

8803
MOTHER
BOARD FOR
S100 BUS
MICRO-
COMPUTERS

• Includes 13
terminal blocks
for 8, 16, 24, 32, 40, 50
pin connectors and 100
pin connector.
• Wiring wire shown. Con-
nects to 8080, 8085, 8088
with wire markings for
component locations.
• 315 square glass board with 2 layer
copper, solder plated and .018
thick for heat.
• Solder mask with solder windows on
etched circuits to avoid accidental
shorts.
• Mounts 11 connectors with 100 contacts (2
rows) on .125 centers with .100 row spacing.
Vector part #8803, 2 or 4 pin 10-275 wire.
• Large holes for 1/16" dia. or 1/8" dia. (1/16")
mounting. (Large holes are per MS-A12-275 wire.)
• Fits on Vector bus connectors.
• Fits on 8080/8085 microcomputers to expand board

Price:
\$29.50

Vector Plugboards

8800V
Universal Microcomputer/processor
plugboard, use with S-100 bus. Com-
plete with heat sink & hardware. 5 1/2" x
10 1/2" x 1 1/16"

1-4 5.8 10.24 14.75 \$4.00 \$3.75

8801-1
Same as 8800V except plain, less power
buses & heat sink

1-4 5.8 10.24 14.75 \$4.00 \$3.75

3677 9.6" x 4.5"
\$10.90

3677-2 6.5" x 4.5"
\$9.74

3652 6.5" x 4.5"
\$8.95

3667-2 9.6" x 4.5"
\$11.45

Gen Purpose O.I.P.
Boards with Bus Pattern
for Solder or Wire Wrap.
Epoxy Glass 1/16" 44
pin c. n. spaced .156

CARD EXTENDER
Card Extender has 100 con-
tacts 50 per side on 125
centers. Attached connec-
tor is compatible with
S-100 Bus Systems. \$25.83
3690 6.5" 22/44 pin .156
ctrs. Extenders \$13.17

1/16" Vector BOARD
.042 dia holes on
.01 spacing for IC's

Phenolic

PART NO.	SIZE	PRICE
84P44XXXP	4.5x6.5"	1.99 10.19
169P44XXXP	4.5x17"	1.56 11.40
		3.69 3.32

Epoxy Glass

84P44	4.5x6.5"	1.79 1.61
84P44	4.5x8.5"	2.21 1.99
169P44	4.5x17"	4.52 4.07
169P84	8.5x17"	8.83 7.95

TRS-80/APPLE
MEMORY EXPANSION KITS

4116's RAMS
from Leading Manufacturers
(16Kx1 200/250ns)

8 for \$75.00

Add \$3.00 for programming Jumpers
for TRS-80 Keyboard

3M SCOTCH® BRAND
DISKETTES

Part No.	Size/ Density	Seccoring	Price Box of 10
740 OP	1-triangle Soft 18M		\$39.95
740Z OP	2-triangle Soft 18M		\$75.00
740Z SP	2-triangle 32		\$35.95
740Z SP	2-triangle 32		\$75.00
741 U	1-triangle Soft		\$59.00
744 OK	1-triangle Soft (TR-80)		\$51.00
744 OK	1-triangle Soft (10)		\$51.00
744 OK	1-triangle Soft (16)		\$51.00

*Price includes Kase-10 Storage Box
a \$5.00 Value (TR-80)
"DON'T SETTLE FOR ANYTHING
LESS THAN SCOTCH"

14 & 16 PIN
GOLD 3 LEVEL
WIRE WRAP
SOCKETS*

14 - G3 100 for
\$36.00

16 - G3 100 for
\$37.00

50 of each for \$38.00

P.C. BOARD
HOLDER

PRICE: \$18.98

115-S same as 315
but with 1/16" bar to
accommodate "S100"
boards

PRICE: \$19.98

STANDARD
VISE HEAD

PRICE: \$14.49

HORIZONTAL
JAW VISE HEAD

PRICE: \$14.49

PANAVISE TILTS, TURNS, AND
ROTATES TO ANY POSITION.
IT HOLDS YOUR WORK
EXACTLY WHERE YOU WANT IT.

PANAVISE

LOW-PROFILE
BASE

PRICE: \$13.49

STANDARD
BASE

PRICE: \$13.49

10% OFF BEFORE
X-MAS

VACUUM BASE

PRICE: \$18.49

WIDE OPENING
VISE HEAD

PRICE: \$14.49

MEMORY MEMORY

2102LIPC Low Power 450ns in lots of 25 **\$1.10**

2102AL-2 Low Power 250ns in lots of 25 **\$1.25**

2114-3L 1Kx4 300 ns Low Power **8/\$50.00**

5257-3L 4Kx1 300ns Low Power **8/\$50.00**

2708 8K 450ns EPROM **8/65.00 \$9.00**

2716 16K 5 Volt Only EPROM **\$40.00**

CALL FOR QUANTITY PRICES

ORDER TOLL FREE
1-800-423-5633
except CA., AK., HI., Call
(213) 894-8171

Vector

WRAP POST
for .042 dia. holes
(all boards on this page)

T44C pkg. 100 \$2.34

T44M pkg.
1000 \$14.35

A-13 hand installing
tool \$4.19

PRIORITY ONE ELECTRONICS

16723K Roscoe Blvd. Sepulveda, CA 91343

Terms: Visa, MC, BAC, Check, Money Order, C.O.D. U.S. Funds Only. CA residents add 6% sales tax.
Minimum order \$10.00 Prepaid U.S. orders less than \$75.00 include 5% shipping and handling,
MINIMUM \$2.50. Excess refunded. Just in case... please include your phone no.
Prices subject to change without notice.
We will do our best to maintain prices thru Dec. 1979
phone orders welcome (213) 894-8171, (800) 423-5633 inquiries invited.

BK PRECISION

TEST
EQUIPMENT
CALL FOR
X-MAS PRICES

ORDER TOLL FREE 1-800-423-5633 ORDER TOLL FREE 1-800-423-5633

HICKOK LX303 \$74.95

HICKOK LX303 \$74.95

North Star Horizon®

1.4 megabyte computer system —

Now double density or quad density (double headed, double sided minifloppy disk drive)



The NORTH STAR HORIZON® is a price-performance leader in S-100 systems. It features a 4 MHz CPU board and double-density disk controller board. All Horizons® now come with two serial RS232C ports, a parallel port, all 12 edge connectors, and an interface cable for connection to an external drive. Horizons are available as single-drive units (Horizon 1) or dual-drive units (Horizon 2). Drives can be double density or double-sided (quad density). A Horizon 2 with two external quad drives gives the user 1.4 megabytes of on-line storage. The Horizon comes with a DOS and North Star Extended Disk BASIC. A CP/M operating system is only \$129.

Just add a terminal and you have a complete and extremely flexible computer system. For example, either the INTERTUBE II or Perkin-Elmer BANTAM 550 video terminals are only \$799 additional from MiniMicroMart.



T.I. 810 PRINTER (basic unit)
with RS232 serial interface, List \$1895 **\$1695**
with RS232 serial and parallel interfaces **1735**

**ANADEx
DOT MATRIX
PRINTER**
List \$995
**ONLY
\$895**



** A few 16K Horizons still available as low as \$1349!*

HORIZON 1 — now fully configured (all options)

32K double-density, Kit, List \$1999	\$1684
Assembled and Tested, List \$2315	\$1959
32K, quad-density, Kit, List \$2199	1869
Assembled and Tested, List \$2565	2174

HORIZON 2 — now fully configured — all options

32K, double-density, Kit, List \$2399	\$2034
Assembled and Tested, List \$2765	2339
32K, quad-density, Kit, List \$2779	2359
Assembled and Tested, List \$3215	2719

Additional 16K RAM with parity
Kit (RAM-16A), List \$399 **\$329**
Assembled and Tested, List \$459 **389**

Additional 32K RAM with parity
Kit (RAM-32), List \$599 **\$499**
Assembled and Tested, List \$659 **549**

Intertec INTERTUBE II List \$995 **\$799**
\$499

NOTE: Horizons may be ordered for future delivery with only 10% deposit.

SHIPPING, HANDLING and INSURANCE: Add \$15 for Horizons, \$10 for terminals or Anadex printer. T.I. printer shipped freight collect. All prices are subject to change and offers are subject to withdrawal without notice. Credit card purchases are 2% higher.

— WRITE FOR FREE CATALOG —

MiniMicroMart, Inc. M61

1618 James Street, Syracuse, NY 13203 (315) 422-4467 TWX 710 541-0431

Terminals and Printers

for every application . . .

Complete Computer!



SUPERBRAIN® by Intertec

- Totally self-contained in a single box
- 32K, 48K, or 64K Version
- Uses two Z-80 CPU's
- Commercial-type terminal with 12" monitor (like the Intertube)
- Dual double-density minifloppies w/360 Kilobytes of storage capacity
- I/O ports included
- Expandable (if needed) with an external S-100 bus interface
- Comes with CP/M™ operating system
- Extensive software support

Sells for well under \$3,000!

Call for price and delivery.



IP-440 PAPER TIGER

- IP-440 Basic Unit, List \$995 **\$895**
 IP-440 w/Graphics Option, incl. Buffer
 List \$1194 **\$1069**
 IP-125 w/1210 Option*, List \$838 **754**
 TRS-80 Cable **45**
 * 1210 Option is expanded and compressed print

BANTAM 550

from PERKIN ELMER

Small in size, light in weight, and low in price — but on top of the list in features and performance.

- Upper and lower case
- Full 24 x 80 format
- Sharp 7 x 10 dot matrix

Get everything you want without paying for things you don't need — List: \$996



NOW FROM
US AT
\$799

Add \$20 for
anti-glare
CRT

ANADEx 80-COLUMN DOT MATRIX PRINTER

Complete upper and lower case ASCII char. set, bi-directional at 84 lines/min. Features RS232 20/60 mil current loop and Centronix parallel interface. Ideal for use with TRS-80, Sorcerer, Cromemco, and North Star systems.

OUR PRICE ONLY \$895

T.I. 810

Bi-directional

150 cps

Logic-
Seeking

Adjustable
Tractor



Call for our low, low prices

- DECwriter II **\$1490**
 Teletype 43 Printers starting at **\$880**
 Lear Siegler ADM3A **\$849**

SHIPPING, HANDLING, & INSURANCE: Intertube, Bantam 550, Anadex, IP-125/225, Teletype 43's, Hazeltine 1500, and ADM3A can be shipped by UPS. Heavier printers shipped air or truck, freight collect.

Prices quoted reflect cash discounts. Credit cards only 2% higher. All prices subject to change and all offers subject to withdrawal without notice.

— WRITE FOR FREE CATALOG —

MiniMicroMart, Inc.

1618 James Street, Syracuse NY 13203 (315) 422-4467 TWX 710-541-0431



INTERTUBE II by Intertec

- 12" Display
- 24 x 80 format
- 18-key numeric keypad
- 128 upper/lower case ASCII characters
- Reverse video, blinking
- Complete cursor addressing and control
- Special user-defined control function keys
- Protected and unprotected fields
- Line insert/delete and character insert/delete editing
- Eleven special line drawing symbols

OUR PRICE \$799



NEC Spinwriter™

The Fantastic Letter-Quality
Printer at 55 cps

— CALL FOR PRICES —

CENTRONICS PRINTERS

- 730 New, friction, & tractor **\$ 895**
 779 (60 cps) — same as TRS-80 printer **\$ 979**
 with Tractor **\$1049**
 702-1 (120 cps, bi-directional) **\$1995**
 703 (185 cps, bi-directional) **\$2395**

SELECTRONICS

Does it again . . . high quality Sylvania monitors at the lowest prices ever. These monitors have been thoroughly checked and guaranteed.



MONITORS

12" black & white monitor. Wide band, will display 80 x 24 char. 10K or 75Ω input impedance, composite video input. Transformer power supply. Shpt. Wt. 30#

Price: \$45.00 ea.

Used with all computers such as: TRS-80, Apple, and many others.

Complete manual \$3.00

**ONLY
\$45.00**



KEYBOARDS

51 key typewriter style keyboard, with case, not encoded. Single contact keys

Shpt. Wt. 10#

Price: \$10.00 ea.

CABLES

5' RG/59U cable with PL259 connector on one end.
Price: \$1.00 ea. 6/\$5.00

24" RG/59U cable with PL 259 connector on one end, BNC on other end.
Price: \$1.00 ea. 6/\$5.00

SPECIAL

Microprocessor Chips #6502

Price: \$6.00 ea. or 2/\$10.00

CENTRONICS 101A

- Model 101A, 60 to 200 lines/minute
- 165 characters/second
- 132 characters/line
- 9 x 7 dot matrix pattern

All models feature fixed vertical/horizontal registration; remote select/deselect; elongate bold face characters (line by line); vertical format unit; two channel VFU; prints originals plus four copies; 8 bit ASCII parallel data input; paper runaway inhibit; audio alarm; printing methods include impact character by character one line at a time.

Excellent condition guaranteed \$550.00

Stand for above \$25.00



DIGITAL DISPLAY BOARDS

6 digit numeric display boards with 6 FND 507. Common anode displays and 10 red LED's. With drivers & logic for multiplexed operation.
Price: \$5.00 ea. or 6/\$25.00



REGULATED DC POWER SUPPLIES MFGS. LAMBDA & NORTH

VOLTS	— AMPS	WT.	PRICE
5	74	62#	\$40.00
5	31	40	35.00
5	16	18	30.00
5	10	18	25.00
5	4	7	20.00
5	13	20	30.00
5	20	30	35.00



ALL ITEMS ARE REMOVED FROM EQUIPMENT

- Test Equipment
- Power Supply Components
- Power Supplies
- Communication Equipment
- Pulse Equipment

SELECTRONICS

✓ S16

TELEPHONES:
Area Code 215
HOWard 8-4645
HOWard 8-7891

1206 S. Napa Street • Philadelphia PA 19146

Penna. resident please add 6% sales tax. ALL PRICES ARE F.O.B. our warehouse, Phila. PA. All merchandise accurate as to description to the best of our knowledge. Your purchase money refunded if not satisfied. Min. order \$10.00.

WAREHOUSE
1206-18 S. Napa Street
1201-49 S. Patton Street
1207-25 S. Napa Street

ADVANCED COMPUTER PRODUCTS

NEW CATALOG AVAILABLE NOW!

THE FIRST TO OFFER PRIME PRODUCTS TO THE HOBBYIST AT FAIR PRICES NOW LOWER PRICES EVEN FURTHER!

1. Proven Quality Factory tested products only, no re-tests or fallouts. Guaranteed money back. We stand behind our products.
1979 CATALOG NOW AVAILABLE
Send \$1.00 for your copy of the most complete catalog of computer products. A must for the serious computer user.

✓ A38

STATIC RAM BOARDS

S-100 32K (uses 2114) *Now just more than 1/2¢ per bit!*
ASSEMBLED Kit 450ns. 599.00
450ns. 599.00 450ns. 539.95
250ns. 699.95 250ns. 599.95
Bare Board 49.95
Bare Board w/all parts less mem. 99.95

S-100 16K (uses 2114) KIT (exp to 32K)
ASSEMBLED 450ns. 279.00
450ns. 325.00 250ns. 299.00
250ns. 375.00
Bare Board 49.95

LOGOS 16K
ASSEMBLED 450ns. 279.00
450ns. 325.00 250ns. 125.95
250ns. 189.95 250ns. 149.95
Bare PC Board w/ Data: \$21.95
Now over 1 year successful field experience
"Special Offer" Buy (4) 8K 450ns. Kits \$117.00

FLOPPY DISK DRIVES

1. VISTA V-80 MINIDISK FOR TRS-80
★ 23% More Storage
★ Capacity - 40 Tracks
★ 40 track patch now avail.
★ Faster Drive -
Up to 8 Times Faster
2 Drive Cable Add \$29.95
4 Drive Cable Add \$39.95
2. VISTA V-200 MINI-FLOPPY SYSTEM
★ 204K Byte Capacity w/CPM, Basic "E"
★ Double Density Drive
★ One Double Density Controller w/Case & P.S.
V-200 \$99.00

Add to your EXIDY, HORIZON, and other S-100 computers.

3. VISTA V-1000 FLOPPY DISK SYSTEM
★ (2) Shugart 8" Floppy Disks
★ Controller Card, Cable, Case & P.S.
★ CPM & Basic "E" Instructions & Manual
4. MPI 851-5V, 40 tracks 279.00
5. Shugart SA400-5V, 35 tracks 295.00
6. Siemens/GSI FDD100-8" 375.00
7. Shugart 800/801R 495.00
8. PERISCOP 800/727 Dual 1195.00
9. WANG/SIEMENS 5 1/4" Drive 290.00

EXPANDABLE MEMORY KITS

★ Bank Selectable ★ Uses 4115 or 4118 200 ns.
★ Power 8VDC, ±16VDC
★ Phantom ★ Lowest Cost/Bt
Expand 32K Kit (4115) Expand 64K Kit (4118)
8K \$168.00 16K \$248.95
16K \$199.00 32K \$369.00
24K \$299.00 48K \$469.00
32K \$349.00 64K \$565.00

IMS STATIC RAM BOARDS

★ Memory Mapping ★ Low Power 8000.00
★ Phantom ★ Assembled & tested
Recommended by Alphamicrosystems
250 ns. 450 ns.
8K Static \$209.00 \$189.00
16K Static \$449.00 \$399.00
32K Static \$799.00 \$699.00

ANADEX PRINTER

Model DP-8000 compact, impact, parallel or serial. Sprocket feed, 80 cols, 84 lines/min., bi-directional. New only \$895.00

FLOPPY DISKETTES

★ 5 1/4" Minidiskettes ★ **LOW PRICE TOP QUALITY DISKETTES**
★ Sanyo, 10 Sector, 15 Sectors
\$4.25 Each, 10/39.95
★ 8" Standard Floppy Disks ★
★ Soft Sector, Hard Sector
\$4.50 Each, 10/41.95
*Add 4.95 for 10 Pack in Deluxe Disk Holder

8800

MOTOROLA EXORCISER COMPATIBLE
9600 MPU Module w/8002 CPU \$495.00
9602 16 Slot Mother Board 175.00
9602 Card Cage (19" Reims Rack Mount) 75.00
9603 8 Slot Mother Board 100.00
9604 Switchmode System Power Supply 250.00
9610 Unity Prototyping Board 36.00
9616 Quad 8K Epm Module 495.00
9620 16 Channel Parallel I/O Module 295.00
9622 Serial/Parallel I/O Combo 295.00
9626 8K Static RAM Module 295.00
9627 16K Static 45ns 495.00
9630 Card Extender 68.00
9640 Multiple Programmable Timer (24 Timers) 395.00
9650 8 Channel Duplex Serial I/O 495.00
96103 32/32 I/O Module 275.00
96702 32 Point Relay Module 350.00

8800 BARE BOARDS

9620-0 \$445.00 9603-0 27.00
9626-0 45.00 9600 55.00
9650-0 45.00 96103 55.00
9601-0 50.00 96702 55.00
Also AMI EVK System in Stock

APPLE/EXIDY/EXPANDO TRS 80 16K-UPGRADE KIT

★ 16K with Jumpers & Instructions for either Level I or Level II \$74.95
★ 16K for Apple II Upgrade \$74.95
Special: TRS80 Schematic, Expansion Interface Schematic \$4.95

TRS 80 to S-100 PET to S-100 ADAPTER

Allows Pet/Trs 80 to be interfaced to popular S-100 Bus.
Pet to S-100 Kit \$189.95
Assembled \$289.95
Trs 80 to S-100 HUH B100 Kit \$275.00
Assembled \$355.00

KEYBOARD ASCII ENCODED

One time purchase of NEW Surplus key-boards. From the Singer Corporation. The keyboard features 128 ASCII characters in a 63 key format. MOS encoder circuitry "N" key rollover, lighted shift lock, control, escape and repeat functions. Ltd Qty **63 KEY \$59.95**

UV "Epm" Eraser

Model UVa-11E \$69.95
Holds 4 Epm's at a time
Backed by 45 years experience
Model S-52T... \$285.00
Professional Industrial Model

TARBELL FLOPPY INTERFACE

★ 280/800 S-100 Compatible ★ Uses CPM
Assembled for Shugart **SALE \$289.95**
Assembled Other Drives \$269.95
Kit \$179.95
Bare Board \$139.95 (Doc. Add \$10.00)
Note: For CPM Add \$70.00. Documentation Add \$20.00
Vista Double Density 5 1/4" Controller Assembled \$299.00
SD Versa Floppy Kit \$199.95
SD Versa Floppy Assembled \$189.95
Tartan Cassette I/O Kit \$115.00
Sale \$171.01 Floppy Chip \$27.95

BYTE USER 8K EPROM BOARD

★ Power on Jump ★ Reset Jump
Assembled & Tested \$94.95
Byleuser Kit \$64.95
Bare PC Board \$21.95
Special Offer: Buy 4 kits only \$59.95 each
MR-8 8K w/1K Ram \$99.50
MR-16 16K w/1K Ram \$99.50
EPM-1 4K 1702 \$59.95
EPM-2 2708 or 2716 Epm \$69.95

Z-80/Z-80A/8080 CPU BOARD

★ On board 2708 ★ 2708 included (450ns.)
★ Power on jump ★ completely socketed
Assembled and tested \$185.00
Kit \$129.95
Bare PC Board \$34.95
★ For 4MHz Speed Add \$15.00
8080A Kit \$99.95
8080A Assembled \$149.95

S-100 MOTHERBOARD SPECIAL

8 slot expandable w/9 conn. reg \$59.95... NOW \$52.95

PROBLEM SOLVER SYSTEM USERS

We recently purchased all finished goods, work in process and product designs from P.S.S. Send for more details.

ACOUSTIC COUPLER

NOVATION MAT
O-300 Baud
Bell 103
Answer, Originate \$198.00

ACOUSTIC COUPLER SPECIAL

AJ Model A30
SPECIAL PURCHASE OF SURPLUS UNITS
AVAILABILITY LIMITED \$29.95

DATA BOOKS ★ COMPUTER BOOKS

1979 IC Master 49.95 Intel MCS 80 Manual 7.95
MSIC TI Data 3.95 Intel MCS 85 Manual 4.95
MSIC Linear 4.95 AMD 8088A Manual 3.95
MSIC Linear App Notes 3.95 AMD 8088A Datasheet 4.95
MSIC CMOS 3.95 AMI MCS 85 Data 3.95
MSIC Memory 3.95 GP MCS 85 Data 4.95
Intel Datasheet 4.95 Harris Analog Datasheet 4.95
Intel MCS 85 Manual 7.50 TI Linear Control Data 3.95
SALE ★ Osborne Books ★ SALE
Intro to Micro Vol. 0 Reg. 7.75
Intro to Micro Vol. 1 7.75
8008 Programming 7.75
8080 Programming 7.75
Z80 Programming 7.75
Vol. 1 Some Real Microprocessors w/Intro 7.75
Vol. 2 Some Real Support Devices w/Intro 7.75
Intro to Micro Vol. 2 7.75
SALE ★ BILLYMIL COMPUTER BOOKS ★ SALE
Understanding Computers 7.95
8008A Microcomputer Experiments 7.95
Beginning BASIC 7.95
Beginning Assembly & Guide 7.95
Pascal Tutor & Jeff's Guide to Computers 7.95
8080 Machine Language Programming 7.95
Home Computer Vol. I Hardware 7.95
Home Computer Vol. II Software 7.95
Benchtop Simulator 7.95

MICROPROCESSORS

2800 16.95
5801 16.95
5802 16.95
5803 16.95
5804 16.95
5805 16.95
5806 16.95
5807 16.95
5808 16.95
5809 16.95
5810 16.95
5811 16.95
5812 16.95
5813 16.95
5814 16.95
5815 16.95
5816 16.95
5817 16.95
5818 16.95
5819 16.95
5820 16.95
5821 16.95
5822 16.95
5823 16.95
5824 16.95
5825 16.95
5826 16.95
5827 16.95
5828 16.95
5829 16.95
5830 16.95
5831 16.95
5832 16.95
5833 16.95
5834 16.95
5835 16.95
5836 16.95
5837 16.95
5838 16.95
5839 16.95
5840 16.95
5841 16.95
5842 16.95
5843 16.95
5844 16.95
5845 16.95
5846 16.95
5847 16.95
5848 16.95
5849 16.95
5850 16.95
5851 16.95
5852 16.95
5853 16.95
5854 16.95
5855 16.95
5856 16.95
5857 16.95
5858 16.95
5859 16.95
5860 16.95
5861 16.95
5862 16.95
5863 16.95
5864 16.95
5865 16.95
5866 16.95
5867 16.95
5868 16.95
5869 16.95
5870 16.95
5871 16.95
5872 16.95
5873 16.95
5874 16.95
5875 16.95
5876 16.95
5877 16.95
5878 16.95
5879 16.95
5880 16.95
5881 16.95
5882 16.95
5883 16.95
5884 16.95
5885 16.95
5886 16.95
5887 16.95
5888 16.95
5889 16.95
5890 16.95
5891 16.95
5892 16.95
5893 16.95
5894 16.95
5895 16.95
5896 16.95
5897 16.95
5898 16.95
5899 16.95
5900 16.95
5901 16.95
5902 16.95
5903 16.95
5904 16.95
5905 16.95
5906 16.95
5907 16.95
5908 16.95
5909 16.95
5910 16.95
5911 16.95
5912 16.95
5913 16.95
5914 16.95
5915 16.95
5916 16.95
5917 16.95
5918 16.95
5919 16.95
5920 16.95
5921 16.95
5922 16.95
5923 16.95
5924 16.95
5925 16.95
5926 16.95
5927 16.95
5928 16.95
5929 16.95
5930 16.95
5931 16.95
5932 16.95
5933 16.95
5934 16.95
5935 16.95
5936 16.95
5937 16.95
5938 16.95
5939 16.95
5940 16.95
5941 16.95
5942 16.95
5943 16.95
5944 16.95
5945 16.95
5946 16.95
5947 16.95
5948 16.95
5949 16.95
5950 16.95
5951 16.95
5952 16.95
5953 16.95
5954 16.95
5955 16.95
5956 16.95
5957 16.95
5958 16.95
5959 16.95
5960 16.95
5961 16.95
5962 16.95
5963 16.95
5964 16.95
5965 16.95
5966 16.95
5967 16.95
5968 16.95
5969 16.95
5970 16.95
5971 16.95
5972 16.95
5973 16.95
5974 16.95
5975 16.95
5976 16.95
5977 16.95
5978 16.95
5979 16.95
5980 16.95
5981 16.95
5982 16.95
5983 16.95
5984 16.95
5985 16.95
5986 16.95
5987 16.95
5988 16.95
5989 16.95
5990 16.95
5991 16.95
5992 16.95
5993 16.95
5994 16.95
5995 16.95
5996 16.95
5997 16.95
5998 16.95
5999 16.95
6000 16.95
6001 16.95
6002 16.95
6003 16.95
6004 16.95
6005 16.95
6006 16.95
6007 16.95
6008 16.95
6009 16.95
6010 16.95
6011 16.95
6012 16.95
6013 16.95
6014 16.95
6015 16.95
6016 16.95
6017 16.95
6018 16.95
6019 16.95
6020 16.95
6021 16.95
6022 16.95
6023 16.95
6024 16.95
6025 16.95
6026 16.95
6027 16.95
6028 16.95
6029 16.95
6030 16.95
6031 16.95
6032 16.95
6033 16.95
6034 16.95
6035 16.95
6036 16.95
6037 16.95
6038 16.95
6039 16.95
6040 16.95
6041 16.95
6042 16.95
6043 16.95
6044 16.95
6045 16.95
6046 16.95
6047 16.95
6048 16.95
6049 16.95
6050 16.95
6051 16.95
6052 16.95
6053 16.95
6054 16.95
6055 16.95
6056 16.95
6057 16.95
6058 16.95
6059 16.95
6060 16.95
6061 16.95
6062 16.95
6063 16.95
6064 16.95
6065 16.95
6066 16.95
6067 16.95
6068 16.95
6069 16.95
6070 16.95
6071 16.95
6072 16.95
6073 16.95
6074 16.95
6075 16.95
6076 16.95
6077 16.95
6078 16.95
6079 16.95
6080 16.95
6081 16.95
6082 16.95
6083 16.95
6084 16.95
6085 16.95
6086 16.95
6087 16.95
6088 16.95
6089 16.95
6090 16.95
6091 16.95
6092 16.95
6093 16.95
6094 16.95
6095 16.95
6096 16.95
6097 16.95
6098 16.95
6099 16.95
6100 16.95
6101 16.95
6102 16.95
6103 16.95
6104 16.95
6105 16.95
6106 16.95
6107 16.95
6108 16.95
6109 16.95
6110 16.95
6111 16.95
6112 16.95
6113 16.95
6114 16.95
6115 16.95
6116 16.95
6117 16.95
6118 16.95
6119 16.95
6120 16.95
6121 16.95
6122 16.95
6123 16.95
6124 16.95
6125 16.95
6126 16.95
6127 16.95
6128 16.95
6129 16.95
6130 16.95
6131 16.95
6132 16.95
6133 16.95
6134 16.95
6135 16.95
6136 16.95
6137 16.95
6138 16.95
6139 16.95
6140 16.95
6141 16.95
6142 16.95
6143 16.95
6144 16.95
6145 16.95
6146 16.95
6147 16.95
6148 16.95
6149 16.95
6150 16.95
6151 16.95
6152 16.95
6153 16.95
6154 16.95
6155 16.95
6156 16.95
6157 16.95
6158 16.95
6159 16.95
6160 16.95
6161 16.95
6162 16.95
6163 16.95
6164 16.95
6165 16.95
6166 16.95
6167 16.95
6168 16.95
6169 16.95
6170 16.95
6171 16.95
6172 16.95
6173 16.95
6174 16.95
6175 16.95
6176 16.95
6177 16.95
6178 16.95
6179 16.95
6180 16.95
6181 16.95
6182 16.95
6183 16.95
6184 16.95
6185 16.95
6186 16.95
6187 16.95
6188 16.95
6189 16.95
6190 16.95
6191 16.95
6192 16.95
6193 16.95
6194 16.95
6195 16.95
6196 16.95
6197 16.95
6198 16.95
6199 16.95
6200 16.95
6201 16.95
6202 16.95
6203 16.95
6204 16.95
6205 16.95
6206 16.95
6207 16.95
6208 16.95
6209 16.95
6210 16.95
6211 16.95
6212 16.95
6213 16.95
6214 16.95
6215 16.95
6216 16.95
6217 16.95
6218 16.95
6219 16.95
6220 16.95
6221 16.95
6222 16.95
6223 16.95
6224 16.95
6225 16.95
6226 16.95
6227 16.95
6228 16.95
6229 16.95
6230 16.95
6231 16.95
6232 16.95
6233 16.95
6234 16.95
6235 16.95
6236 16.95
6237 16.95
6238 16.95
6239 16.95
6240 16.95
6241 16.95
6242 16.95
6243 16.95
6244 16.95
6245 16.95
6246 16.95
6247 16.95
6248 16.95
6249 16.95
6250 16.95
6251 16.95
6252 16.95
6253 16.95
6254 16.95
6255 16.95
6256 16.95
6257 16.95
6258 16.95
6259 16.95
6260 16.95
6261 16.95
6262 16.95
6263 16.95
6264 16.95
6265 16.95
6266 16.95
6267 16.95
6268 16.95
6269 16.95
6270 16.95
6271 16.95
6272 16.95
6273 16.95
6274 16.95
6275 16.95
6276 16.95
6277 16.95
6278 16.95
6279 16.95
6280 16.95
6281 16.95
6282 16.95
6283 16.95
6284 16.95
6285 16.95
6286 16.95
6287 16.95
6288 16.95
6289 16.95
6290 16.95
6291 16.95
6292 16.95
6293 16.95
6294 16.95
6295 16.95
6296 16.95
6297 16.95
6298 16.95
6299 16.95
6300 16.95
6301 16.95
6302 16.95
6303 16.95
6304 16.95
6305 16.95
6306 16.95
6307 16.95
6308 16.95
6309 16.95
6310 16.95
6311 16.95
6312 16.95
6313 16.95
6314 16.95
6315 16.95
6316 16.95
6317 16.95
6318 16.95
6319 16.95
6320 16.95
6321 16.95
6322 16.95
6323 16.95
6324 16.95
6325 16.95
6326 16.95
6327 16.95
6328 16.95
6329 16.95
6330 16.95
6331 16.95
6332 16.95
6333 16.95
6334 16.95
6335 16.95
6336 16.95
6337 16.95
6338 16.95
6339 16.95
6340 16.95
6341 16.95
6342 16.95
6343 16.95
6344 16.95
6345 16.95
6346 16.95
6347 16.95
6348 16.95
6349 16.95
6350 16.95
6351 16.95
6352 16.95
6353 16.95
6354 16.95
6355 16.95
6356 16.95
6357 16.95
6358 16.95
6359 16.95
6360 16.95
6361 16.95
6362 16.95
6363 16.95
6364 16.95
6365 16.95
6366 16.95
6367 16.95
6368 16.95
6369 16.95
6370 16.95
6371 16.95
6372 16.95
6373 16.95
6374 16.95
6375 16.95
6376 16.95
6377 16.95
6378 16.95
6379 16.95
6380 16.95
6381 16.95
6382 16.95
6383 16.95
6384 16.95
6385 16.95
6386 16.95
6387 16.95
6388 16.95
6389 16.95
6390 16.95
6391 16.95
6392 16.95
6393 16.95
6394 16.95
6395 16.95
6396 16.95
6397 16.95
6398 16.95
6399 16.95
6400 16.95
6401 16.95
6402 16.95
6403 16.95
6404 16.95

JADE Computer Products

74LS CHIPS 15% OFF !!!

MEMORY PRICES REDUCED !!!

S D SYSTEMS SALE !!!

S D SYSTEMS EXPANDORAM

EXPANDABLE TO 64K USING 4116 RAMS

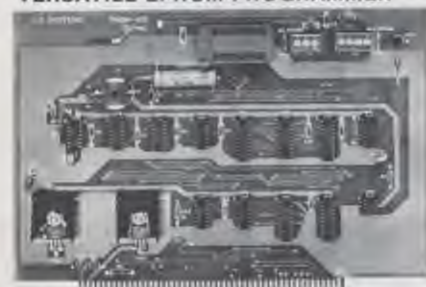


Interfaces with most popular S-100 boards
Bank selectable; PHANTOM provision
Draws only 5 watts fully populated
Designed to work with Z-80, 8080, and 8085 systems
No wait states required
16K boundaries & protect via dip switches
Kits come with sockets for full 64K
Invisible refresh

MEM-16130K (16K KIT)	\$199.00
MEM-16130A (16K A&T)	\$249.00
MEM-32131K (32K KIT)	\$265.00
MEM-32131A (32K A&T)	\$315.00
MEM-48132K (48K KIT)	\$339.00
MEM-48132A (48K A&T)	\$389.00
MEM-64133K (64K KIT)	\$394.00
MEM-64133A (64K A&T)	\$444.00

S D SYSTEMS PROM-100

VERSATILE EPROM PROGRAMMER

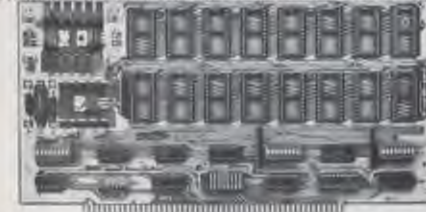


S-100 bus compatible (note: board height 7")
Dip switch selects 2708, 2716, 2732, 2758, or 2516's
25 VDC programming pulse generated on board
Programming time only 100 seconds for 16K bits
Support software listing provided in manual
Program and erasure verification
Software provides for reading of object file from
CP/M and programming into EPROM

MEM-99520K (KIT)	\$145.00
MEM-99520A (A&T)	\$215.00

S D SYSTEMS EXPANDOPROM

EXPANDABLE TO 32K USING 2716 EPROMS



S-100 bus compatible, uses 2708 or 2716 EPROMs
Dip switches allow selection of: each EPROM, 16K
or 32K boundary, wait states

MEM-32220K (KIT)	\$135.00
MEM-32220A (A&T)	\$199.00

GET THE INSIDE TRACK JADE DOUBLE-D DOUBLE DENSITY DISK CONTROLLER

Read/write single or double density, 8" or 5 1/4" drives
On board Z-80 insures reliable operation
CP/M compatible in either single or double density
Density is software selectable
Up to 4 single or double sided, single or double
density drives may be mixed on the same system
EIA level serial printer interface on board-up to 9600
baud (perfect for despooling operations)
All the hard work of disk access is done by the on
board Z-80A and 2K memory, leaving your host
CPU free for its normal duties

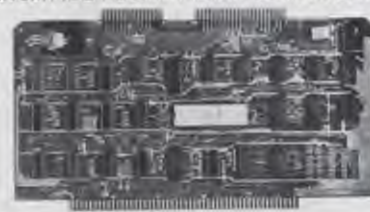
Uses IBM standard formats for proven reliability
THIS BOARD REALLY WORKS !!!!!!
IOD-1200K (DOUBLE-D KIT) \$285.00
IOD-1200A (DOUBLE-D A&T) \$349.00
IOD-1200D (MANUAL ONLY) \$15.00

S D SYSTEMS VERSAFLOPPY II DOUBLE DENSITY DISK CONTROLLER



Single or double density floppy disk controller
985600 bytes on 8" double sided diskettes
259840 bytes on double sided 5 1/4" diskettes
S-100 bus (IEEE) standard compatible
IBM 3740 format in single density
8" and 5 1/4" drives controlled simultaneously
Operates with Z-80, 8080, and 8085 CPU's
Controls up to 4 drives
Vectored interrupt operation optional
IOD-1160K (KIT) \$305.00
IOD-1169A (A&T) \$399.00

S D SYSTEMS VERSAFLOPPY VERSATILE FLOPPY DISK CONTROLLER



IBM 3740 soft sector format
S-100 Z-80 or 8080 compatible
Controls up to 4 single or double sided drives
Compatible with all popular disk drives
CP/M compatible
Listings for control software included
IOD-1150K (KIT) \$139.00
IOD-1150A (A&T) \$229.00

NEW 2 OR 4 MHz REV. C BOARD THE JADE BIG Z

Z-80 CPU BOARD WITH SERIAL I/O PORT
2 or 4 MHz switchable, on-board 2708, 2716, or 2732
EPROM useable in SHADOW mode (full 64K RAM)
Automatic MWRITE generation if no front panel
On-board USART for sync or async RS232
CPU-30201K (KIT) \$159.00
CPU-30201A (A & T) \$209.00

S D SYSTEMS EXPANDORAM II 4 MHz RAM BOARD EXPANDABLE TO 256K



S-100 bus compatible, up to 4 MHz operation
Expandable memory from 16K to 256K
Dip switch selectable boundaries
Page-mode allows up to 8 boards on the same bus
Invisible refresh; PHANTOM output disable
Designed to operate in Z-80 based systems
MEM-16631K (16K KIT) \$275.00
MEM-16631A (16K A&T) \$325.00
MEM-32632K (32K KIT) \$359.00
MEM-32632A (32K A&T) \$410.00
MEM-48632K (48K KIT) \$445.00
MEM-48632A (48K A&T) \$495.00
MEM-64632K (64K KIT) \$529.00
MEM-64632A (64K A&T) \$579.00

S D SYSTEMS VDB-8024

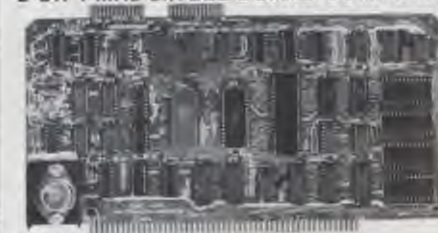
80 X 24 I/O MAPPED VIDEO BOARD



80 character by 24 line display, 7 X 10 dot matrix
Composite or separate TTL video outputs
On-board keyboard interface with power
On-board Z-80 and 2K RAM
Blink, underline, reverse, protect, up/down scroll
Upper/lower case characters, 32 special characters
Optional 128 user-programmable characters
IOV-1020K (KIT) \$295.00
IOV-1020A (A&T) \$459.00

S D SYSTEMS SBC-100/200

2 OR 4 MHz SINGLE BOARD COMPUTER



S-100 bus compatible Z-80 CPU
1K of on-board RAM
4 EPROM sockets accommodates 2708, 2716, or 2732
One parallel and one serial I/O port
4-channel counter timer chip (Z-80 CTC)
Software programmable serial baud rates
CPC-30100K (2 MHz KIT) \$215.00
CPC-30100A (2 MHz A&T) \$345.00
CPC-30200K (4 MHz KIT) \$255.00
CPC-30200A (4 MHz A&T) \$365.00

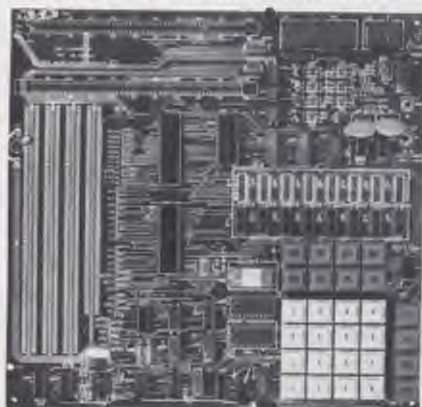
PRICES SLASHED FOR JANUARY !!!!

CALL TOLL-FREE AND SAVE

800-421-5809 CONTINENTAL U.S.

800-262-1710 INSIDE CALIFORNIA

S D SYSTEMS Z-80 STARTER KIT COMPLETE Z-80 MICROCOMPUTER



On-board keyboard, display, EPROM programmer, and cassette interface.
On-board S-100 interface.
Wire-wrap area and room for 2 S-100 connectors.
Two 8-bit parallel I/O ports, 4-channel CTC, 5 programmable breakpoints.
Examine and change memory, I/O ports, or register.
CPS-30010K (KIT) \$219.00
CPS-30010A (A&T) \$365.00

CP/M 2.0

Digital Research has done it again! This new release of their industry standard disk operating system is bound to be an even bigger hit than the original version. All of the fundamental file-size restrictions of release 1 have been eliminated, while maintaining full compatibility with the earlier versions. This new release can be field-configured by the user for a single mini-disk up through a multiple drive hard-disk system with 128 megabyte capacity. Field configuration can be accomplished easily through use of the Macro Library (DISKDEF) provided with CP/M 2.0.

A powerful operating system for only ... \$150.00

JADE'S NEW MOTHERBOARDS THE ISO-BUS WE'RE PROUD OF OUR MOTHER!

6-SLOT

BARE BOARD \$24.95
KIT \$49.95
ASSEMBLED & TESTED \$59.95

12-SLOT

BARE BOARD \$39.95
KIT \$89.95
ASSEMBLED & TESTED \$99.95

18-SLOT

BARE BOARD \$59.95
KIT \$129.95
ASSEMBLED & TESTED \$149.95

SPECIAL PACKAGE PRICE ROCKWELL AIM-65 THE HEAD-START IN MICROCOMPUTERS

KIM-1 compatible
On-board printer
Full ASCII keyboard

AIM-65 w/1K RAM..\$375.00
AIM-65 w/4K RAM..\$450.00
8K BASIC ROM..\$100.00
POWER SUPPLY..\$59.95
CASE for AIM-65..\$49.95

4K Assembler/Editor..\$80.00
Special Package Price \$599.00
4K AIM-65, 8K BASIC ROM, Power Supply, and Case.



JADE MEMORY EXPANSION KITS FOR TRS-80 APPLE EXIDY

Everything you need to add 16K of memory to your computer. Your kit comes neatly packaged with easy to follow instructions. In just minutes your computer is ready to tackle more advanced software.

\$75.00

AVAILABLE IN FEBRUARY NEW JADE P/S I/O PARALLEL/SERIAL/INTERRUPT BOARD

Z-80 SIO/PIO, 2 CTCs, expands to 2 SIOs, 4 CTCs
4 serial ports (async, sync, bisync, SDLC/HDLC)
2 parallel ports with full handshake
Software baud rate generators, interval timers, counters, and generates 32 vectored interrupts
Designed especially for MP/M multi-user multi-tasking operating systems. For use with Z-80 only
IOI-1045B (BARE BOARD) \$45.00
IOI-1045K (KIT) \$169.95
IOI-1045A (A & T) \$224.95

MICROPROCESSORS

F8	\$16.95
Z80 (2MHz)	\$10.95
Z80A (4MHz)	\$14.95
CDP1802CD	\$24.95
6502	\$11.95
6800	\$12.50
6802	\$12.50
8008-1	\$15.95
8035	\$24.00
8035-B	\$24.00
8080-A	\$10.00
8085	\$23.00
TMS9900TL	\$49.95

8080A SUPPORT DEVICES

B212	\$5.00
B214	\$4.65
B216	\$2.95
B224 (2MHz)	\$4.30
B226	\$2.75
B228	\$6.40
B238	\$6.40
B243	\$8.00
B251	\$7.50
B253	\$20.00
B255	\$6.40
B257	\$19.95
B259	\$19.95
B275	\$89.95
B279	\$17.70

USRT

S2350	\$10.95
-------	---------

UARTS

AYS-1013A	\$5.25
AYS-1014A	\$8.25
TR1602B	\$5.25
TMS6011	\$5.95
IMS403	\$9.00

BAUD RATE GENERATORS

MC14411	\$10.00
---------	---------

6800 PRODUCT

6821P	\$5.25
6828P	\$12.00
6834P	\$16.95
6850P	\$4.80
6852P	\$7.50
6865P	\$9.25
6862P	\$12.00
6875L	\$7.50
6880P	\$2.50

CHARACTER GENERATORS

2513 Upper	\$7.95
2513 Lower	\$6.75
2513 Upper (5 volt)	9.75
2513 Lower (5 volt)	\$13.00
MCM6571 up scan	\$13.00
MCM6571A down scan	\$10.95

PROMS

1702A	\$5.00
2708	\$8.95
2716	\$39.95
2716 (5v)	\$39.95
2758 (5v)	\$30.00

DYNAMIC RAMS

4116/416D 8 for	\$74.95
2104/4096	\$4.75
2107B-4	\$3.95
TMS4027/4096	\$4.75

STATIC RAMS

21L02 (450ns)	\$1.50
21L02 (250ns)	\$1.75
2101-1	\$2.95
2111-1	\$3.25
2112-1	\$2.95
2114L (450ns)	\$5.75
2114L (300ns)	\$5.95
TMS4044 (450ns)	\$8.00
TMS4044 (300ns)	\$9.95
410D (200ns)	\$9.95
4200A (200ns)	\$9.95

JADE Computer Products

4901 W ROSECRANS, HAWTHORNE, CA 90250
213-679-3313

PLACE ORDERS TOLL FREE

800-262-1710 800-421-5809
INSIDE CALIFORNIA CONTINENTAL U.S.

WRITE FOR OUR FREE 1979 CATALOG
FOR CUSTOMER SERVICE OR TECHNICAL INQUIRIES
CALL 213-679-3317

TERMS OF SALE: Cash, checks, money orders, and credit cards accepted. Minimum order \$10.00. California residents add 6% sales tax. Minimum shipping and handling charge \$2.50. Prices are for U.S. and Canadian delivery only and are subject to change without notice. For export prices and information send for a JADE INTERNATIONAL CATALOG.



INTEGRAL DATA SYSTEMS THE PAPER TIGER 132 COLUMN DOT MATRIX PRINTER

Up to 198 CPS
1.75 to 9.5 inch adjustable tractor and friction feed.
Parallel and serial interface.
98 character ASCII set.
80 to 132 columns.
6 or 8 lines per inch.
Eight software selectable character sizes.
110, 300, 600, or 1200 baud.



PRM-33440 \$995.00
PRM-33441 (with graphics & 2K buffer) .. \$1195.00

DISKETTE SPECIAL

5.25" SOFT, 10, OR 16 SECTOR

10 for \$29.95

8" SOFT SECTOR IBM COMPATIBLE

10 for \$34.95

S-100 CONNECTOR SALE

100 PIN IMSAI TYPE SOLDER-TAIL CONNECTOR

6 for \$17.50 12 for \$30.00

SPST DIP SWITCHES

PART NUMBER	NUMBER OF SWITCHES	PRICE
SWD-103	3	\$1.00 \$1.18
SWD-104	4	\$1.05 \$1.20
SWD-105	5	\$1.10 \$1.24
SWD-106	6	\$1.15 \$1.28
SWD-107	7	\$1.20 \$1.30
SWD-108	8	\$1.25 \$1.34
SWD-109	9	\$1.30 \$1.36
SWD-110	10	\$1.35 \$1.38



16 PIN ZIP* DIP II \$5.50
24 PIN ZIP* DIP II \$7.50
40 PIN ZIP* DIP II \$10.25

* ZERO INSERTION PRESSURE

SPECIAL HOLIDAY PRICE! NOVATION CAT ACOUSTIC COUPLER/MODEM



Let your computer talk to other computers!
Bell Systems 103 compatible
300 baud, answer or originate
IOM-5200A (SALE PRICED)

Radio Hut
201 LOCHWOOD MALL • DALLAS, TEXAS 75218
ORDER BY PHONE—214-324-5509

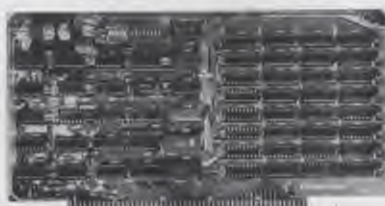
PLEASE WRITE FOR CATALOG OR
WHILE IN DALLAS, VISIT OUR RETAIL
STORE AT 201 LOCHWOOD MALL,
DALLAS, TEXAS 75218
(GARLAND ROAD AT JUPITER).

ORDERING INFORMATION & TERMS: Orders under \$15.00 add 75¢ handling. No C.O.D. We accept Visa, MasterCard, and American Express cards. Tex. Res. add 5% tax. Foreign orders (except Canada) add 20% P&H. 90 Day Money Back Guarantee on all items. Add 5% P&H, maximum \$5.00.
ORDER BY PHONE—(214) 324-5509

The EXPANDORAM is available in versions from 16K up to 64K, so for a minimum investment you can have a memory system that will grow with your needs. This is a dynamic memory with the invisible on-board refresh, and IT WORKS!

- Bank Selectable
- Phantom
- Power 8VDC, +16VDC, 5 Watts
- Lowest Cost Per Bit
- Uses Major Brand 16K RAMS
- PC Board is doubled solder masked and has silk-screened parts layout
- Extensive documentation clearly written

SD EXPANDORAM



- Complete kit includes all Sockets for 64K
- Memory access time: 375ns, Cycle time: 500ns.
- No wait states required
- 16K boundaries and Protection, via Dip Switches
- Designed to work with Z-80, 8080, 8085 CPUs

EXPANDORAM 64K Kit (16K Ram)

WITHOUT MEMORY	\$139.00
16K	209.00
32K	275.00
48K	340.00
64K	405.00

SD'S PROM 100 PROM Programmer Board
The PROM-100 Programmer is a development tool for S-100 Bus computer systems. The Zero Insertion Force Programming Socket extends above the card cage height for easy access to PROM devices. Software verifies PROM erasure, verifies program loading and provides for reading of object file from Disk or PROM and programming into PROM/EPROM. Features include: On-board generated 25vdc Programming pulse, TTL compatible, maximum programming time for 16,389 bits is 100 seconds. Programs: 2708, Intel 2758, 2716, 2732 and TI 2516. DIP Selectable EPROM type.

PROM-100 Board Kit \$149.95

SD'S MPB-100 Z80 CPU BOARD KIT

The MPB-100 provides, a Z80 microprocessor based CPU for S-100 Bus systems. Front panel usage is optional, making the MPB-100 suitable for upgrading existing systems to Z80 level. A PROM socket is provided on-board which makes the MPB-100 adaptable to process control applications. Features include: Power-on Jump to 4K boundaries, 2 Megahertz or 4 Megahertz operation, optional wait states, on-board PROM socket.

MPB-100 KIT \$199.00

SD'S VERSAFLOPPY II
• IBM 3740 Compatible Soft Sector Format for Single Density Drives • Operates with Single and Dual Sided Drives, Single or Double Density Drives and 5" & 8" Drives — in any combination of four simultaneously • Drive Select and Side Select Circuitry • S-100 Bus Compatible • Vectored Interrupt Operation Optional • Phase Locked Loop Data Recovery Circuit • Operates with Z80 CPU's • Uses FD1791-1 Controller Chip • The Versafloppy II incorporates all the possible features of a flexible disk drive controller into one board. Capable of handling four drives simultaneously, combinations of any variety are possible, such as 5" single sided, 8" dual density dual sided, 5" dual density single sided. Most popular drives are controlled directly with the Versafloppy II. The operating system for the Versafloppy II is the extremely powerful SOOS available for SD Systems. Diagnostic and control software available to complete your disk system.

\$290 KIT, \$385.00 ASSEMBLED & TESTED



SD'S VDB-8024 VIDEO DISPLAY BOARD

The VDB-8024 features its own on-board Z80 microprocessor. This gives the capability of using software (included in ROM) to control functions and enhancements without interference with the computer's CPU. Included in the special features: 80 characters by 24 lines display, keyboard power and interface, composite and separate video output, 2K on-board RAM, a total of 256 available characters, full cursor control, forward and reverse scrolling, underlining, field reverse, field protect enhancements, programmable characters.

VDB-8024 KIT \$289.00

SD'S "VERSAFLOPPY I" KIT

FEATURES: IBM 3740 soft sector compatible, S-100 BNS Compatible for Z-80 or 8080. Controls up to 4 drives (single or double sided). Directly controls the following drives: Sugart SA400/450 Mini Floppy • Shugart SA800/850 Standard Floppy • PERSCI 70 and 277 • MFE 700/750 • CDC 9404/9406

\$135.00



SD'S SBC-100 SINGLE BOARD COMPUTER

The SBC-100 provides a complete micro-computer on a single board! The Z80 microprocessor is used as the heart of the SBC-100. The SBC-100 meets all the requirements of a Z80 CPU board with the added features of I/O ports, counter/timer channels, on board RAM, provisions for PROM/ROM and a software programmable baud rate generator. S-100 Bus compatible, the SBC-100 features are: 8K bytes of available PROM, 1024 bytes on-board RAM, Serial I/O with both synchronous and asynchronous operation, Parallel I/O ports, Operational Vectored Interrupts, and Four Counter/Timer Channels. SD Monitor available for RS-232 and Video Terminals. Disk based system software also available.

SBC-100 KIT \$209.00

TARBELL FLOPPY DISK INTERFACE
Compatible with Z80 & 8080. S-100 Bus. Uses CPM operating system. Plugs directly into your IMSAI or ALTAIR • Fastest transfer rate
KIT \$190.00 Assembled & Tested \$260.00

TARBELL CASSETTE INTERFACE
Plugs directly into your IMSAI or ALTAIR • Fastest transfer rate • Extremely reliable • Phase encoded • 4 extra status & control lines
KIT \$99.95

Z80 STARTER KIT
Kit: \$219.95 Assembled & Tested \$369.95

SD Systems' Z80 Starter Kit enables the novice to build a complete microcomputer on a single board. Featuring the powerful Z80 microprocessor, the Z80 Starter Kit features:

- Keyboard and Display
- Audio Interface
- PROM Programmer
- Expansion and Wire Wrap Area
- On Board RAM
- 4 Channel Counter/Timer
- Z-BUG Monitor in PROM
- I/O Ports.



COMPUTER CORNER CPU'S

Z80	\$10.99
RELATED CHIPS	
2114 (300ns)	\$5.99
Z80 PIO	\$9.95
2708	\$7.99
4115	8/\$34.95
4116	8/\$80.00
DISC CONTROLLER	
1771	\$29.95
1791	\$37.95

DIP SWITCHES

3 Pos.	\$1.10
4 Pos.	\$1.12
5 Pos.	\$1.16
6 Pos.	\$1.20
7 Pos.	\$1.22
8 Pos.	\$1.26
9 Pos.	\$1.36
10 Pos.	\$1.30

LED'S AND READOUT	
Jumbo Red LED's	8/1.00
Jumbo Green LED's	4/7.95
Jumbo Yellow LED's	4/7.95
Jumbo Amber LED's	4/7.95
MV Red	10/1.00
FND 70CC	.50
DL 707	.95
DL 747CA	.65
DL 728CC	1.19
FND 800CC	1.50
Red Filter 4" Bezel	2.50
Green Filter 4" Bezel	2.50
Amber Filter 4" Bezel	2.50
4N25	1.60
4N26	1.25
4N27	1.10
4N28	.95
4N31	1.20

IC SOCKETS

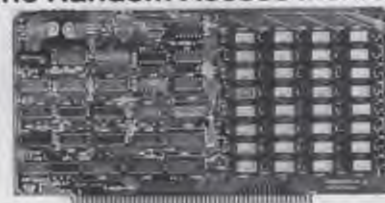
SOLDER TIN		LOW PROFILE	
PIN		PIN	
8	.12	16	.17
14	.15	18	.24
24	.32	40	.54
28	.39	20	.26

S-100 CONNECTORS
High-Quality Gold Pins
\$2.99 EACH

FLOPPY DISK SPECIAL
5.25" SOFT, 10 OR 16 SECTOR
10 FOR \$29.95
8" SOFT SECTORED IBM COMPATIBLE
10 FOR \$34.95

- S-100 Bus Compatible
- Up to 4Mhz Operation
- Expandable Memory from 16K to 256K
- DIP Switch Selectable Boundaries
- Uses 16K (4116) or 64K (4164) Memory Devices
- Page Mode Operation Allows up to 8 Memory Boards on Bus
- Operates with Z80 CPU's
- Phantom Output Disable
- Invisible Refresh (Synchronized with Wait States)

SD'S EXPANDORAM II The Random Access Memory



SD Systems' ExpandoRAM II is a dynamic RAM board with capacities from 16K bytes (4116) to 256K bytes (4164). It operates on the industry S-100 Bus. The design allows 8 boards to operate from the same S-100 Bus. The ExpandoRAM II is compatible with most S-100 CPU's based on the Z80 microprocessor.

EXPANDORAM II KIT

W/O	\$195.00
16K	285.00
32K	375.00
48K	465.00
64K	555.00

Power Supplies! Power Supplies! Power Supplies! **SOLID STATE!! (5)** **We got 'em! Take your pick...**

These units are ideal for micro computers. They have been removed from equipment, checked out and guaranteed.

- 1—5 volts @ 8 amps + 12 volts @ 2 amps + 6 volts @ 75 MA. Power supply has a 3-wire line cord and fused. Dimensions: 10 1/2" x 5 1/2" x 4 1/2". Shipping weight: 16 lbs. 37.50 ea. 2/70.00
- 2—Model 818, 5 volts at 15 amps + 12 volts at 4 amps—12 volts at 2 amps. (with line cord). 35.00 ea. 2/65.00
- 3—+ 5 volts at 5 amps ± 12 volts at 500 ma. + 6 volts at 25 ma. (line cord included)... 32.95 ea. 2/60.00
- 4—Elxon, multi output. Input: 120/240 AC, +10%, 47-63 hz; output: 1) 12V, 1.5A, DC, OVP; 2) 12V, 1.5A, D.C., OVP. New, in box with operating instructions. 31.50
- 5—Power Design, Model 1210, constant voltage, DC. P.S. input: 105-125. A.C., 55 to 440 hz. Output: 1-12 volts, 0-10 amps, DC. continuously adjustable output voltage and current limiting. 139.00

COMPUTER GRADE CAPACITORS . . .

18,000 mfd 10 VDC	1.25	11,000 mfd 25 VDC	1.50	4,000 mfd 75 VDC	1.75
4,400 mfd 20 VDC	1.00	35,000 mfd 35 VDC	3.50	1,000 mfd 100 VDC	1.00
46,000 mfd 20 VDC	2.50	10,000 mfd 50 VDC	2.50	6,800 mfd 100 VDC	3.50
3,000 mfd 25 VDC	1.00	22,000 mfd 60 VDC	3.75	4,700 mfd 150 VDC	3.75

WIRE WRAP BOARDS

These boards have been removed from equipment. They're prewired, and very easy to unwrap for setting up your own boards. Contains mostly 14-pin IC sockets with individual connections. Each board has VCC and ground planes.

Smaller board measures 6 1/2"x6" and has 40 to 50 sockets. Reduced Price . . . \$7.50 ea. 2/\$14.00

Larger board measures 13 1/2"x6" and has 75 to 100 sockets. Reduced Price . . . \$12.50 ea. 2/\$23.00

DIABLO System Disc Drive

SERIES 40, MODEL 43

100 tracks per inch, total capacity of 50 megabits, w/Model 429 power supply, sector counter, 24 sectors, 1 fixed disc, 1 removable disc, average access time 38 ms, PPM:2400, dimensions: 10 5/16" high, fits in standard rack, equipped with full extension slides, excellent used condition. Shipped freight collect.

\$2495



HEWLETT-PACKARD MODEL 175A OSCILLOSCOPES

THESE SCOPES HAVE A 50 MHZ BANDWIDTH AND HAVE 2 PLUG-INS, A 1781B DELAY GENERATOR AND A MODEL 1755A DUAL TRACE VERTICAL AMPLIFIER. DIMENSIONS: 13" x 17" x 25", WEIGHT 71 LBS, SHIPPED FREIGHT COLLECT, 5" CRT. USED. CHECKED OUT AND OPERATING.



\$339

TRANSFORMERS

ISOLATION STEP-DOWN TYPE

Primary: 230/115V, 50/60
CPS, Secondary: 115 volts
output 250 VA.

\$13.95
EACH

ROTRON WHISPER FANS

Unused, Model Rotron
MU 3A1, 230V, AC, 14
watts, 50/60 hz, guar-
anteed, 4 1/2"x4 1/2"x1 1/2"

\$8.95

Clock Crystal Oscillators—ITL, Vectron, type CO-231T. Crystal freq. 4.9152 mhz. Input voltage 5 VDC ±. Output: Drives 10 TTL Loads Logic "0": 0.4V max., sink 16ma. Logic "1" 2.4V min source 2 ma. (above 50 mhz drives 2 Schottky TTL loads). Tuning adjust. with nominal range of ±30 ppm below 25 mhz and 15 ppm above 25 mhz. R.F.E. 1 1/2"x1 1/2"x1 1/2". \$13.95

SG-132 SWEEP SIGNAL GENERATOR

FREQ: 15 TO 400 MHZ, VHF-UHF

Output: AM & FM: CW. FM deviation: ± 1% to ± 20% at any frequency. Crystal markers every 200Khz, 1mhz, 5mhz or ± 10B. Frequency accuracy ±1%. Built-in oscilloscope for observing waveforms.

\$329

TRENDLINE PHONES

Manufactured by I.T.T.

These units have rotary dials. Colors are: white, black, red, and green. They are packaged and have 6-foot cord and installation instructions. Used, but in good operating condition.

34.50 WALL TYPE

Minimum order \$25.00. Items offered subject to prior sale. FOB, Brockton, Mass. Money order or check w/order. Shipments and handling add 5%. Shipments by parcel post or UPS. No CODs. Mass. residents add 5% sales tax.

WALLEN

ELECTRONICS CO. INC. Tel: (617) 588-6440-6441
108 SAWTELL AVE., BROCKTON, MA. 02402

ELECTRONIC COMPONENTS
TEST EQUIPMENT
CONNECTORS - WIRE

16K EPROM CARD-S 100 BUSS



\$59.95
KIT

OUR
BEST
SELLING
KIT!

USES 2708's!

Thousands of personal and business systems around the world use this board with complete satisfaction. Puts 16K of software on line at **ALL TIMES!** Kit features a top quality soldermasked and silk-screened PC board and first run parts and sockets. All parts (except 2708's) are included. Any number of EPROM locations may be disabled to avoid any memory conflicts. Fully buffered and has WAIT STATE capabilities.

OUR 450NS 2708'S
ARE \$8.95 EA. WITH
PURCHASE OF KIT

ASSEMBLED
AND FULLY TESTED
ADD \$25

16K STATIC RAM KIT-S 100 BUSS

PRICE CUT!

\$279 KIT

FOR 250NS
ADD \$10

FULLY
STATIC, AT
DYNAMIC PRICES



WHY THE 2114 RAM CHIP?

We feel the 2114 will be the next industry standard RAM chip (like the 2102 was). This means price, availability, and quality will all be good! Next, the 2114 is FULLY STATIC! We feel this is the **ONLY** way to go on the S-100 Bus! We've all heard the HORROR stories about some Dynamic Ram Boards having trouble with DMA and FLOPPY DISC DRIVES. Who needs these kinds of problems? And finally, even among other 4K Static RAM's the 2114 stands out! Not all 4K static Rams are created equal! Some of the other 4K's have clocked chip enable lines and various timing windows just as critical as Dynamic RAM's. Some of our competitor's 16K boards use these "tricky" devices. But not us! The 2114 is the **ONLY** logical choice for a trouble-free, straightforward design.

KIT FEATURES:

1. Addressable as four separate 4K Blocks
2. ON BOARD BANK SELECT circuitry (Cromemco Standard!) Allows up to 512K on line!
3. Uses 2114 (450NS) 4K Static Rams.
4. ON BOARD SELECTABLE WAIT STATES
5. Double sided PC Board, with solder mask and silk screened layout. Gold plated contact fingers.
6. All address and data lines fully buffered.
7. Kit includes ALL parts and sockets
8. PHANTOM is jumpered to PIN 67.
9. LOW POWER: under 2 amps TYPICAL from the 48 Volt Bus.
10. Blank PC Board can be populated as any multiple of 4K.

BLANK PC BOARD W/DATA—\$33

LOW PROFILE SOCKET SET—\$12
SUPPORT IC'S & CAPS—\$19.95

ASSEMBLED & TESTED—ADD \$30

8K LOW POWER RAM KIT-S 100 BUSS SALE

PRICE
CUT!

\$119.50
KIT

(450 NS RAMS!)



Thousands of computer systems rely on this rugged, work horse, RAM board. Designed for error-free, NO HASSLE, systems use.

KIT FEATURES:

1. Doubled sided PC Board with solder mask and silk screen layout. Gold plated contact fingers.
2. All sockets included.
3. Fully buffered on all address and data lines.
4. Phantom is jumper selectable to pin 67.
5. FOUR 7805 regulators are provided on card.

Blank PC Board w/Documentation
\$29.95

Low Profile Socket Set...13.50

Support IC's (TTL & Regulators)
\$9.75

Bypass CAP's (Disc & Tantalums)
\$4.50

ASSEMBLED AND FULLY
BURNED IN ADD \$30

16K STATIC RAM SS-50 BUSS

PRICE CUT!

\$275 KIT

FULLY STATIC
AT DYNAMIC PRICES



KIT FEATURES:

1. Addressable on 16K Boundaries
2. Uses 2114 Static Ram
3. Runs at Full Speed
4. Double sided PC Board. Solder mask and silk screened layout. Gold fingers.
5. All Parts and Sockets included
6. Low Power: Under 2 Amps Typical

FOR SWTPC
6800 BUSS!

ASSEMBLED AND
TESTED - \$30

BLANK PC BOARD—\$33

COMPLETE SOCKET SET—\$12

SUPPORT IC'S AND CAPS—\$19.95

S-100 Z80 CPU CARD

ASSEMBLED AND TESTED! READY TO USE! Over 3 years of design efforts were required to produce a TRUE S-100 Z80 CPU at a genuinely bargain price! **4 MHZ! \$159.95**

FEATURES:

- * 2 or 4 MHZ Operation.
- * Generates MWRITE, so no front panel required.
- * Jump on reset capability
- * 8080 Signals emulated for S-100 compatibility.
- * Top Quality PCB, Silk Screened, Solder Masked, Gold Plated Contact Fingers.

Perfect For
OEM's

LOW POWER - 250NS 2114 RAM SALE!

4K STATIC RAM'S. MAJOR BRAND, NEW PARTS.
These are the most sought after 2114's. LOW POWER and 250NS FAST. **\$7.50 ea. or 8 For \$55**
SPECIAL SALE: (We reserve the right to limit quantities.)

NOT ASSOCIATED WITH DIGITAL RESEARCH OF CALIFORNIA, THE SUPPLIERS OF CPM SOFTWARE.

PROC. TECH. QUILTS THE MICROPROCESSOR BUSINESS! FACTORY CLOSE OUT - SPECIAL PURCHASE!

#16KRA

16K S-100 Dynamic Ram Board - \$149.95

ORIGINALLY PRICED AT \$429 each!

We purchased the remaining inventory of PT's popular 16K Ram Board when they recently closed their plant. Don't miss the boat! These are brand new, fully tested, ASSEMBLED and ready to go. All are sold with our standard 90 day limited warranty!!

72 Page Full Manual, Included Free!

Digital Research: Computers
(OF TEXAS)

P.O. Box 401565 • GARLAND, TEXAS 75040 • (214) 494-1505

TERMS: Add \$1.00 postage, we pay balance. Orders under \$15 add 75¢ handling. No C.O.D. We accept Visa, MasterCard, and American Express cards. Tex. Res. add 5% Tax. Foreign orders except Canada add 20% P & H. 90 Day Money Back Guarantee on all items.

10-DAY FREE TRIAL

Send for our
FREE Catalog



\$100 FREE ACCESSORIES WITH 16K or 32K PET

When you buy a 16K or 32K PET, apply \$100 toward PET accessories. FREE. Just indicate on your order that you have reduced the cost of your accessories by \$100.

**FREE
SAVE
\$69**

Terminal Package with 8K PETs

See Special Below

PET ACCESSORIES

8K-Keyboard N	\$795
16K-Keyboard B	\$995
16K-Keyboard N	\$995
32K-Keyboard C	\$1,295
32K-Keyboard B	\$1,295
32K-Keyboard N	\$1,295

C—calculator keyboard (only version with tape deck)
B—large keyboard (graphics not on keys)
N—large keyboard with graphics symbols

Commodore Dual Floppy Disk Drive	\$1,100
CompuLink 800K Disk Drive	\$1,295
Commodore Printer (tractor feed)	\$849
Commodore Printer (friction feed)	\$995.00
Second Cassette from Commodore	\$95.00
Commodore PET Service Kit	\$30.00
Beeper—Tells when tape is loaded	\$24.95
Petunia—Play music from PET	\$29.95
Video Buffer—Attach another CRT	\$29.95
Combo-Petunia and Video Buffer	\$49.95
New Serial Printer Interface for PET	\$79.95
KIM 1 (A Single Board Computer from Commodore)	\$179.00



Hazeltine 1400

Immediate Delivery—
2-Year Factory Warranty

LIST SALE
~~\$850~~ **\$649**

Hazeltine 1410 — \$835	Hazeltine 1510 — \$1195
Hazeltine 1500 — \$1069	Hazeltine 1520 — \$1499

Lear Siegler's ADM-3A

Back Again at Our Lowest Price Ever

The ADM-3A is industry's favorite dumb terminal for some very smart reasons:

- 12 in. diagonal screen
- Full or half duplex operation at 11 selectable data rates
- 1920 easy-to-read characters in 24 rows of 80 letters
- Typewriter-style keyboard
- RS-232 C interface extension port
- Direct cursor addressing

Our Low Sale Price \$795

SAVE \$195
COMMODORE DISK DRIVES
Reg. \$1,295 Sale \$1,100

apple II plus

\$200 FREE ACCESSORIES

The new Apple II with Applesoft BASIC built-in! Eliminates the need for a \$200 Firmware Card and includes new Autostart ROM for easy operation. This combined with the FREE accessories from NCE could save you up to \$400 on a 48K Apple II system!

16K Apple II Plus — \$1,195 (take \$100 in free accessories)
32K Apple II Plus — \$1,345 (take \$150 in free accessories)
48K Apple II Plus — \$1,495 (take \$200 in free accessories)

Apple II Accessories	
General Business	\$62E
PASCAL	\$49E
Integer BASIC ROM Card	\$200
VISI-CalC	\$99
Centronics Printer Interface	\$225
Disk and Controller	\$595
Parallel Printer Card	\$180
Communications Card	\$225
Hi-Speed Serial Card	\$195
Firmware Card	\$200

IN STOCK NOW!

EVERY ITEM IN THIS ADVERTISEMENT IS IN STOCK AND READY TO SHIP, EXCEPT WHERE NOTED.

PAPER TIGER 440SPE

The Graphics Printer for Apple II

Now you can print illustrations, block letters, charts, graphs, and more—all under software control. And with the expanded buffer, the Paper Tiger can hold the text from an entire 24-line-by-80-column CRT screen.

\$1194.00

PET OWNERS...

REMOTE TERMINAL for only \$69

A self-contained module and program cassette enables your PET to function as a 300 baud terminal. Supports Upper/Lower case, Rubout, Escape & all control functions. Output is TTL.

FREE WITH PET PURCHASE



CAT COUPLER

New 300 baud Originate/Answer Acoustic Coupler. Looks good, works great. priced at **\$189**

NEW from Heath Data Systems

The All-In-One Computer

Dual Z-80 Processors • Built-in 102K Floppy Disk • 16K to 48K RAM • 25 x 80 Character Display • Upper/Lower Case and Line Graphics • 80 Character Keyboard with Keypad • 8 User-definable Keys • Two BASIC's and Auto-Scribe Word Processing available • Can support CP/M

Heath's third generation of computers is a compact, hi-style desktop unit which includes a complete terminal, a computer and a disk All-In-One! System includes Bootstrap in ROM, other programs available separately. HDOS operating system includes Heath's BASIC, an assembler and text editor along with important disk utilities. Microsoft language requires HDOS.

WH89 with 16K RAM	\$2,295
WH89 with 32K RAM	\$2,445
WH89 with 48K RAM	\$2,595
WH17 Second Disk Drive	\$550
Dual-port Serial Interface	\$85
HDOS Operating System	\$100
Microsoft BASIC	\$100
Word Processing	\$395

NEW! ZENITH COLOR VIDEO MONITOR

Zenith's first color video display designed specifically for computers.

This 13-inch monitor is Zenith's first color video display designed specifically for computers. Features include automatic color level, color processing and degaussing circuits.

Zenith Color Monitor \$499.00

FREE Just Released Compumart's New Fall/Winter 1979 Catalog.

We've just published our catalog and it's packed with new products and money saving specials. Our illustrated 32-page book features microcomputers and microcomputer systems from Apple, Commodore PET, Heath, and Exidy Sorcerer. Also covered are the Commodore's KIM and Rockwell's AIM. A broad selection of terminals, books, software and peripherals are presented in detail. The text is thorough and provides a wealth of technical information. To get your FREE copy write to our address below. Please include the dept. number to speed handling.

CENTRONIC'S 779-2 PRINTER

TRACTOR FEED	SALE PRICE \$1095
• Parallel interface	• Form thickness control
• Continuous variable printing density 80-132 characters per line	• Horizontal and vertical form positioning
• 5x7 dot matrix	• Used with controller (Apple general business software)

SANYO MONITOR

\$169 \$279
9-inch ~~\$240~~ 15-inch ~~\$400~~



CompuMart
DEPT. BC10

SINCE 1971

270 THIRD ST., CAMBRIDGE, MA 02142

To Order: **1 (800) 343-5504**

In Mass.: **1 (617) 491-2700**



Member:
Computer Dealers
Association

IMPORTANT ORDERING INFORMATION

All orders must include 4% shipping and handling. Mass. residents add 5% sales tax; Mich. residents 4% for sales tax.

Phones open from 8:30 a.m. to 5:30 p.m. EST Mon.-Fri. • P.O.'s accepted from D&B rated companies — shipment contingent upon receipt of signed purchase order • Sorry no C.O.D.s • All prices are subject to change without notice • Most items in stock for immediate shipment — call for delivery quotation • In the Ann Arbor area? Our retail store is open 11:00 a.m. to 7:00 p.m. Tues.-Fri., 10:00 a.m. to 5:00 p.m. Saturdays (closed Sun. and Mon.)

If not satisfied, return your purchase within 10 days for full refund of purchase price!

TU-ART
Digital
Interface

Cromemco's TU-ART digital interface is a convenient interface for C&T terminals, file printers, modems, and other devices. Has 2 serial I/O ports, and 10 independent software-selectable baud rates are available. Parallel I/O ports, 5-bit handshaking, and other features. Has vectored interrupt inputs so it is able to support the 24-bit vectored interrupt structure of a 286-bit microprocessor. Its interval timer's 2-year-time capability.

Serial I/O Ports

1. 1000 baud rate

2. 1000 baud rate

3. 1000 baud rate

4. 1000 baud rate

5. 1000 baud rate

6. 1000 baud rate

7. 1000 baud rate

8. 1000 baud rate

9. 1000 baud rate

10. 1000 baud rate

11. 1000 baud rate

12. 1000 baud rate

13. 1000 baud rate

14. 1000 baud rate

15. 1000 baud rate

16. 1000 baud rate

17. 1000 baud rate

18. 1000 baud rate

19. 1000 baud rate

20. 1000 baud rate

21. 1000 baud rate

22. 1000 baud rate

23. 1000 baud rate

24. 1000 baud rate

25. 1000 baud rate

26. 1000 baud rate

27. 1000 baud rate

28. 1000 baud rate

29. 1000 baud rate

30. 1000 baud rate

31. 1000 baud rate

32. 1000 baud rate

33. 1000 baud rate

34. 1000 baud rate

35. 1000 baud rate

36. 1000 baud rate

37. 1000 baud rate

38. 1000 baud rate

39. 1000 baud rate

40. 1000 baud rate

41. 1000 baud rate

42. 1000 baud rate

43. 1000 baud rate

44. 1000 baud rate

45. 1000 baud rate

46. 1000 baud rate

47. 1000 baud rate

48. 1000 baud rate

49. 1000 baud rate

50. 1000 baud rate

51. 1000 baud rate

52. 1000 baud rate

53. 1000 baud rate

54. 1000 baud rate

55. 1000 baud rate

56. 1000 baud rate

57. 1000 baud rate

58. 1000 baud rate

59. 1000 baud rate

60. 1000 baud rate

61. 1000 baud rate

62. 1000 baud rate

63. 1000 baud rate

64. 1000 baud rate

65. 1000 baud rate

66. 1000 baud rate

67. 1000 baud rate

68. 1000 baud rate

69. 1000 baud rate

70. 1000 baud rate

71. 1000 baud rate

72. 1000 baud rate

73. 1000 baud rate

74. 1000 baud rate

75. 1000 baud rate

76. 1000 baud rate

77. 1000 baud rate

78. 1000 baud rate

79. 1000 baud rate

80. 1000 baud rate

81. 1000 baud rate

82. 1000 baud rate

83. 1000 baud rate

84. 1000 baud rate

85. 1000 baud rate

86. 1000 baud rate

87. 1000 baud rate

88. 1000 baud rate

89. 1000 baud rate

90. 1000 baud rate

91. 1000 baud rate

92. 1000 baud rate

93. 1000 baud rate

94. 1000 baud rate

95. 1000 baud rate

96. 1000 baud rate

97. 1000 baud rate

98. 1000 baud rate

99. 1000 baud rate

100. 1000 baud rate

101. 1000 baud rate

102. 1000 baud rate

103. 1000 baud rate

104. 1000 baud rate

105. 1000 baud rate

106. 1000 baud rate

107. 1000 baud rate

108. 1000 baud rate

109. 1000 baud rate

110. 1000 baud rate

111. 1000 baud rate

112. 1000 baud rate

113. 1000 baud rate

114. 1000 baud rate

115. 1000 baud rate

116. 1000 baud rate

117. 1000 baud rate

118. 1000 baud rate

119. 1000 baud rate

120. 1000 baud rate

121. 1000 baud rate

122. 1000 baud rate

123. 1000 baud rate

124. 1000 baud rate

125. 1000 baud rate

126. 1000 baud rate

127. 1000 baud rate

128. 1000 baud rate

129. 1000 baud rate

130. 1000 baud rate

131. 1000 baud rate

132. 1000 baud rate

133. 1000 baud rate

134. 1000 baud rate

135. 1000 baud rate

136. 1000 baud rate

137. 1000 baud rate

138. 1000 baud rate

139. 1000 baud rate

140. 1000 baud rate

141. 1000 baud rate

142. 1000 baud rate

143. 1000 baud rate

144. 1000 baud rate

145. 1000 baud rate

146. 1000 baud rate

147. 1000 baud rate

148. 1000 baud rate

149. 1000 baud rate

150. 1000 baud rate

151. 1000 baud rate

152. 1000 baud rate

153. 1000 baud rate

154. 1000 baud rate

155. 1000 baud rate

156. 1000 baud rate

157. 1000 baud rate

158. 1000 baud rate

159. 1000 baud rate

160. 1000 baud rate

161. 1000 baud rate

162. 1000 baud rate

163. 1000 baud rate

164. 1000 baud rate

165. 1000 baud rate

166. 1000 baud rate

167. 1000 baud rate

168. 1000 baud rate

169. 1000 baud rate

170. 1000 baud rate

171. 1000 baud rate

172. 1000 baud rate

173. 1000 baud rate

174. 1000 baud rate

175. 1000 baud rate

176. 1000 baud rate

177. 1000 baud rate

178. 1000 baud rate

179. 1000 baud rate

180. 1000 baud rate

181. 1000 baud rate

182. 1000 baud rate

183. 1000 baud rate

184. 1000 baud rate

185. 1000 baud rate

186. 1000 baud rate

187. 1000 baud rate

188. 1000 baud rate

189. 1000 baud rate

190. 1000 baud rate

191. 1000 baud rate

192. 1000 baud rate

193. 1000 baud rate

194. 1000 baud rate

195. 1000 baud rate

196. 1000 baud rate

197. 1000 baud rate

198. 1000 baud rate

199. 1000 baud rate

200. 1000 baud rate

201. 1000 baud rate

202. 1000 baud rate

203. 1000 baud rate

204. 1000 baud rate

205. 1000 baud rate

206. 1000 baud rate

207. 1000 baud rate

208. 1000 baud rate

209. 1000 baud rate

210. 1000 baud rate

211. 1000 baud rate

212. 1000 baud rate

213. 1000 baud rate

214. 1000 baud rate

215. 1000 baud rate

216. 1000 baud rate

217. 1000 baud rate

218. 1000 baud rate

219. 1000 baud rate

220. 1000 baud rate

221. 1000 baud rate

222. 1000 baud rate

223. 1000 baud rate

224. 1000 baud rate

225. 1000 baud rate

226. 1000 baud rate

227. 1000 baud rate

228. 1000 baud rate

229. 1000 baud rate

230. 1000 baud rate

231. 1000 baud rate

232. 1000 baud rate

233. 1000 baud rate

234. 1000 baud rate

235. 1000 baud rate

236. 1000 baud rate

237. 1000 baud rate

238. 1000 baud rate

239. 1000 baud rate

240. 1000 baud rate

241. 1000 baud rate

242. 1000 baud rate

243. 1000 baud rate

244. 1000 baud rate

245. 1000 baud rate

246. 1000 baud rate

247.

THERE'S NO NEED TO COMPROMISE WITH COMPUPRO™

We don't compromise on our designs so you don't have to compromise on performance. Our expanded S-100 line is the answer to the needs of professional computer users — just ask the dealers who specify our components when making up systems for scientific, commercial, and industrial applications. Speaking of dealers, Godbout products (under the CompuPro™ name) are now available from more dealers than ever before... which makes it even easier for you to experience Godbout quality in person. Shop around, compare prices, and compare specs: we think we know whose products will earn a space in your computer.

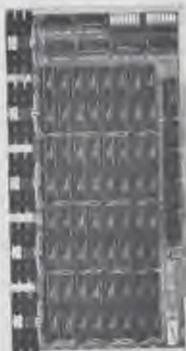
MORE NEWS FROM THE MEMORY LEADER.

This month, we spotlight **Econoram XIII** — an S-100 bank select board that's completely compatible with Alpha Micro, Cromemco, and similar systems (all 8 bits of the data word are available for bank select). Addressable on 4K boundaries. Available in 16K, 24K, or 32K configurations; see list below (which includes our other popular memories) for prices.

All Econoram™ memories are fully static, run with 5 MHz (or slower) systems, include a 1 year limited warranty, and generally come in three different configurations to suit your needs — **unkit, assembled and tested, or qualified under our high-reliability Certified System Component program** (200 hour burn-in, immediate replacement in event of failure within 1 year of invoice date).



Name	Bus & Notes	Unkit	Asm	CSC
8K Econoram IIA	S-100	\$149	\$179	\$239
16K Econoram IV	S-100	\$269	\$329	\$429
16K Econoram VIIA-16	S-100	\$279	\$339	\$439
24K Econoram VIIA-24	S-100	\$398	\$485	\$605
16K Econoram IX-16	Dig Grp	\$319	\$379	n/a
32K Econoram IX-32	Dig Grp	\$559	\$639	n/a
32K Econoram X	S-100	\$529	\$649	\$789
32K Econoram XI	SBC/BLC	n/a	n/a	\$1050
16K Econoram XIII-16	S-100 (1)	\$329	\$419	\$519
24K Econoram XIII-24	S-100 (1)	\$429	\$539	\$649
32K Econoram XIII-32	S-100 (1)	\$559	\$699	\$849
16K Econoram XIV	S-100 (2)	\$299	\$359	\$459
16K Econoram XV-16	H8 (3)	\$329	\$395	n/a
32K Econoram XV-32	H8 (3)	\$599	\$729	n/a
16K x 16 or 32K x 8 Econoram XVI — coming soon!				



(1) Bank select board addressable on 4K boundaries.
(2) Extended addressing (24 address lines). Single block addressable on 4K boundaries.
(3) Bank select option for implementing memory systems greater than 64K.

Econoram is a trademark of Godbout Electronics.

THE GODBOUT COMPUTER BOX: \$259 desk top, \$299 rack mount (introductory price)

The ideal home for your computer. Includes dual AC outlets and fuseholder on rear, power switch, heavy-duty line filter, black anodized front panel (with textured vinyl painted cover for desk top version); pre-drilled base accepts our high-performance S-100 motherboards or types by Vector, California Digital, and others. Rack mount version includes slides for easy pull-out from rack for maintenance or board changing. You can even cut a hole in the front panel and put in a mini-floppy... all in all, this is a functional, versatile, and handsome enclosure that does justice to the finest computer systems.

LIMITED QUANTITY SPECIAL: PASCAL/M™ MEMORY!

PASCAL can give a microcomputer with CP/M more power than many minis! And for a limited time only, you can buy an assembled 32K Econoram X, with our totally standard Wirth PASCAL/M™ 8" diskette, for \$799 (regular combined price, \$999). Includes manual, plus Wirth's definitive book on PASCAL; specify 280 or 8080/8085 version. Hurry — this is an introductory special. Diskette only without memory board: \$350.

DO YOU SPEAK TRS-80**?

We've been expanding the memory of Model I TRS-80** machines for over a year now with our low power, high speed memory expansion chip set (\$87.20). Now you can use the same chip to expand memory in Apple, newer PET, Exidy Sorcerer, and Heath H89 machines — as well as expand a 32K Model II TRS-80** to 48K or even 64K. And if that isn't enough memory for you, watch this space for news on our high-density, Model II compatible 64K board with bank select!

**TRS-80 is a trademark of the Tandy Corporation.

HIGH-PERFORMANCE MOTHERBOARDS

19 slot: \$174 unkit, \$214 asm
12 slot: \$129 unkit, \$169 asm
6 slot: \$ 89 unkit, \$129 asm

Unkits have edge connectors and termination resistors pre-soldered in place for easy assembly. These boards exceed the latest S-100 specs and will work with 5 to 10 MHz CPUs. Includes true active termination, grounded Faraday shield between all buss signal lines, and edge connectors for all slots.

2708 EROM BOARD \$85 unkit

4 independently addressable 4K blocks, with dipswitch selectable jump start built right into the board. Includes all support chips and manual, but does not include EROMs.

ACTIVE TERMINATOR BOARD \$34.50 kit

Plugs into any S-100 motherboard (although ours don't need it) to reduce ringing, crosstalk, noise, and other buss-related problems.

S-100 MEMORY MANAGER BOARD \$59 kit, \$85 asm, \$100 CSC

Now you can add bank select and extended addressing to older S-100 machines like the Altair, IMSAI, Sol, Polymorphic, etc. Either use this board with our new extended addressing boards, or retrofit our high density Econorams (the ones with phantom or extra qualifier lines) for use with the Memory Manager to get up to 1/2 a megabyte of memory space for your computer.

2S "Interfacer" S-100 I/O Board \$189 unkit, \$249 asm, \$324 CSC

Dual RS-232 ports with full handshake; EIA232C line drivers and receivers (1488, 1489) along with current loop (20 mA) and TTL signals on both ports. On-board crystal controlled timebase with independently selectable Baud rate generators for each port (up to 19.2 Kbaud). Hardware UARTs.

3P PLUS S "Interfacer II" S-100 I/O Board \$189 unkit, \$249 asm, \$324 CSC

Incorporates 1 channel of serial I/O (with all the features of a port from the 2S "Interfacer"), along with 3 full duplex parallel ports. The parallel section uses LSTTL octal latches for latched input and output data with 24 mA drive current, attention/enabled and strobe bits for each parallel port (with selectable polarity), interrupts for each input port, and separate 25 pin connectors with power for each channel along with a status port for interrupt mask and port status.

TERMS: Allow 5% for shipping excess refunded. Cal res add tax. VISA/Mastercharge®: call our 24 hr. order desk at (415) 562-0636. COD OK with street address for UPS. Prices good through cover month of magazine.

CompuPro™

from

GODBOUT
ELECTRONICS

G4

SEND FOR OUR
FREE CATALOGUE

725 Wright St., Oakland Airport, CA 94614 415-562-0636

WAMECO

THE COMPLETE PC BOARD HOUSE EVERYTHING FOR THE S-100 BUSS

* FPB-1 FRONT PANEL BOARD, Hex Displays, IMSAI Replaceable. PCBD	\$54.95
* FDC-1 FLOPPY DISC CONTROLLER BOARD Controls up to 8 Discs. PCBD	\$45.00
* MEM-1A 8K BYTE 2102 RAM BOARD PCBD	\$31.95
KIT 450 NSEC	\$141.95
* MEM-2 16K BYTE 2114 RAM BOARD PCBD	\$31.95
KIT 450 NSEC	\$299.95
* CPU-1 8080A CPU BOARD with Vector Interrupt. PCBD	\$31.95
KIT	\$124.95
* EPM-1 4K BYTE 1702A EPROM PCBD	\$29.95
KIT LESS PROMS	\$59.95

* EPM-2 16K or 32K BYTE EPROM 2708 or 2176 Interchangeable. PCBD	\$30.00
KIT LESS PROMS	\$74.95
* QMB-9 9 SLOT MOTHER BOARD Terminated. PCBD	\$35.00
KIT	\$89.95
* QMB-12 12 SLOT MOTHER BOARD Terminated. PCBD	\$45.00
KIT	\$115.95
* RTC-1 REALTIME CLOCK Programmable Interrupts	\$27.95
KIT	\$79.95
* PTB-1 POWER SUPPLY BOARD PCBD	\$30.95
KIT LESS REGULATORS	\$55.95

FUTURE PRODUCTS: 80 CHARACTER VIDEO BOARD, IO BOARD WITH CASSETTE INTERFACE.

DEALER INQUIRIES INVITED, UNIVERSITY DISCOUNTS AVAILABLE AT YOUR LOCAL DEALER

W22

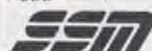
WMC inc.

WAMECO INC. 111 GLENN WAY #8, BELMONT, CA 94002 (415) 592-6141



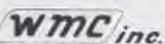
CALIFORNIA COMPUTER SYSTEMS

16K RAM BOARD Fully buffered addressable in 4K blocks. IEEE standard for bank addressing 2114's PCBD	\$26.95
KIT 450 NSEC	\$259.95
PT-1 PROTO BOARD Over 2,600 holes 4" regulators. All S-100 buss functions labeled, gold fingers PCBD	\$25.95
PT-2 PROTO BOARD Similar to PT-1 except set-up to handle solder tail sockets. PCBD	\$25.95



FORMERLY CYBERCOM/SOLID STATE MUSIC

PB-1 2708 & 2716 Programming Board with provisions for 4K, 8K, EPROM. No external supplies, require test socket. Kit	\$124.95
CB-1A 8080 Processor Board, 2K of PROM 256 BYTE RAM power on/rest Vector Jump Parallel port with status. Kit	TBD
MB-6B Basic 8KX8 ram uses 2102 type rams, S-100 buss. Kit 450 NSEC	\$139.95
PCBD	\$26.95
MB-7 16KX8, Static RAM uses μ P410 Protection, fully buffered. Kit	\$299.95
MB-8A 2708 EPROM Board, S-100, 8KX8 or 16KX8 kit without PROMS \$75.00 PCBD	\$28.95
VB-3 80x55 VIDEO BOARD Graphic included	TBD
IO-2 S-100 8 bit parallel I/O port, 2's of boards is for kludging. Kit	\$46.00
PCBD	\$26.95
IO-4 Two serial I/O ports with full handshaking 20/60 ma current loop. Two parallel I/O ports. Kit	\$130.00
PCBD	\$26.95
VB-1B 64 x 16 video board, upper lower case Greek, composite and parallel video with software, S-100. Kit	\$125.00
PCBD	\$26.95
Altair Compatible Mother Board, 11 x 11 1/2 x 1 1/2" Board only	\$39.95
With 15 connectors	\$94.95
Extended Board full size. Board only	\$ 9.49
With connector	\$13.45
SB-1 Synthesizer Board S-100 PCBD	\$42.95
KIT	\$135.95



WAMECO INC.

FDC-1 FLOPPY CONTROLLER BOARD will drive shugart, peritek, remic 5" & 8" drives up to 8 drives, on board PROM with power boot up, will operate with CPM (not included) PCBD	\$42.95
FPB-1 Front Panel IMSAI size hex displays, Byte, or instruction single step PCBD	\$47.50
MEM-1A 8KX8 fully buffered, S-100, uses 2102 type rams. PCBD	\$25.95
QMB-12 MOTHER BOARD, 13 slot, terminated, S-100 board only	\$38.75
CPU-1 8080A Processor board S-100 with 8 level vector interrupt PCBD	\$26.95
RTC-1 Realtime clock board, Two independent interrupts, Software programmable. PCBD	\$23.95
EPM-1 1702A 4K EPROM card PCBD	\$25.95
EPM-2 2708/2716 16K/32K EPROM CARD PCBD	\$25.95
QMB-9 MOTHER BOARD, Short Version of QMB-12 9 Slots PCBD	\$30.95
MEM-2 16K x 8 Fully Buffered 2114 Board PCBD	\$26.95
PTB-1 POWER SUPPLY AND TERMINATOR BOARD PCBD	\$25.95
8080A	\$9.95
2708	\$8.99
8212	2.49
2114 (450 NS) low pwr	5.99
8214	4.49
2114 (250 NS) low pwr	6.99
8224	3.49
2102A-4L	1.20

MIKOS

(415) 592-1800

P. O. Box 424 • San Carlos, California 94070

Please send for IC, Xistor and Computer parts list

M39

JAN. SPECIAL SALE ON PREPAID ORDERS

(Charge cards not included on this offer)

FPB-1 with MIKOS #14	
Front Panel Kit	\$119.95
8Kx8 Ram 450 NSEC fully buffered, 2.5 amps typical	\$99.99

MIKOS PARTS ASSORTMENT WITH WAMECO AND CYBERCOM PCBDS

MEM-2 with MIKOS #7 16K ram with L2114 450 NSEC	\$249.95
MEM-2 with MIKOS #13 16K ram with L2114 250 NSEC	\$279.95
MEM-1 with MIKOS #1 450 NSEC 8K RAM	\$119.95
CPU-1 with MIKOS #2 8080A CPU	\$94.95
MEM-1 with MIKOS #3 250 NSEC 8K RAM	\$144.95
QMB-12 with MIKOS #4 13 slot mother board	\$89.95
RTC-1 with MIKOS #5 real time clock	\$54.95
EPM-1 with MIKOS #10 4K 1702 less EPROMS	\$49.95
EPM-2 with MIKOS #11 16-32K EPROMS less EPROMS	\$59.95
QMB-9 with MIKOS #12 9 slot mother board	\$79.95
FPB-1 with MIKOS #14 all parts for front panel	\$134.95

MIKOS PARTS ASSORTMENTS ARE ALL FACTORY PRIME PARTS. KITS INCLUDE ALL PARTS LISTED AS REQUIRED FOR THE COMPLETE KIT LESS PARTS LISTED. ALL SOCKETS INCLUDED.

VISA or MASTERCARD: Send account number, interbank number, expiration date and sign your order. Approx. postage will be added. Check or money order will be sent post paid in U.S. If you are not a regular customer, please use charge, cashiers check or postal money order. Otherwise there will be a two-week delay for checks to clear. Calif. residents add 6% tax. Money back 30 day guarantee. We cannot accept returned IC's that have been soldered to. Prices subject to change without notice. \$10 minimum order. \$1.50 service charge on orders less than \$10.00.

AIM 65 BY ROCKWELL INTERNATIONAL



AIM 65 is fully assembled, tested and warranted. With the addition of a low cost, readily available power supply, it's ready to start working for you.

AIM 65 features on-board thermal printer and alphanumeric display, and a terminal-style keyboard. It has an addressing capability up to 65K bytes, and comes with a user-dedicated 1K or 4K RAM. Two installed 4K ROMs hold a powerful Advanced Interface Monitor program, and three spare sockets are included to expand on-board ROM or PROM up to 20K bytes.

An Application Connector provides for attaching a TTY and one or two audio cassette recorders, and gives external access to the user-dedicated general purpose I/O lines.

Also included as standard are a comprehensive AIM 65 User's Manual, a handy pocket reference card, an R6500 Hardware Manual, an R6500 Programming Manual and an AIM 65 schematic.

AIM 65 is packaged on two compact modules. The circuit module is 12 inches wide and 10 inches long, the keyboard module is 12 inches wide and 4 inches long. They are connected by a detachable cable.

THERMAL PRINTER

Most desired feature on low-cost microcomputer systems . . .

- Wide 20-column printout
- Versatile 5 x 7 dot matrix format
- Complete 64-character ASCII alphanumeric format
- Fast 120 lines per minute
- Quite thermal operation
- Proven reliability

FULL-SIZE ALPHANUMERIC KEYBOARD

Provides compatibility with system terminals . . .

- Standard 54 key, terminal-style layout
- 26 alphabetic characters
- 10 numeric characters
- 22 special characters
- 9 control functions
- 3 user-defined functions

TRUE ALPHANUMERIC DISPLAY

Provides legible and lengthy display . . .

- 20 characters wide
- 16-segment characters
- High contrast monolithic characters
- Complete 64-character ASCII alphanumeric format

PROVEN R6500 MICROCOMPUTER SYSTEM DEVICES

Reliable, high performance NMOS technology . . .

- R6502 Central Processing Unit (CPU), operating at 1 MHz. Has 65K address capability, 13 addressing modes and true index capability. Simple but powerful 56 instructions.
- Read/Write Memory, using R2114 Static RAM devices. Available in 1K byte and 4K byte versions.
- 8K Monitor Program Memory, using R2332 Static ROM devices. Has sockets to accept additional 2332 ROM or 2532 PROM devices, to expand on-board Program memory up to 20K bytes.
- R6532 RAM-Input/Output-Timer (RIOT) combination device. Multipurpose circuit for AIM 65 Monitor functions.
- Two R6522 Versatile Interface Adapter (VIA) devices, which support AIM 65 and user functions. Each VIA has two parallel and one serial 8-bit, bidirectional I/O ports, two 2-bit peripheral handshake control lines and two fully-programmable 16-bit interval timer/event counters.

BUILT-IN EXPANSION CAPABILITY

- 44-Pin Application Connector for peripheral add-ons
- 44-Pin Expansion Connector has full system bus
- Both connectors are KIM-1 compatible

TTY AND AUDIO CASSETTE INTERFACES

Standard interface to low-cost peripherals . . .

- 20 ma. current loop TTY interface
- Interface for two audio cassette recorders
- Two audio cassette formats: ASCII KIM-1 compatible and binary, blocked file assembler compatible

ROM RESIDENT ADVANCED INTERACTIVE MONITOR

Advanced features found only on larger systems . . .

- Monitor-generated prompts
- Single keystroke commands
- Address independent data entry
- Debug aids
- Error messages
- Option and user interface linkage

ADVANCED INTERACTIVE MONITOR COMMANDS

- Major Function Entry
- Instruction Entry and Disassembly
- Display/Alter Registers and Memory
- Manipulate Breakpoints
- Control Instruction/Trace
- Control Peripheral Devices
- Call User-Defined Functions
- Comprehensive Text Editor

LOW COST PLUG-IN ROM OPTIONS

- 4K Assembler—symbolic, two-pass . . . A65-010 \$79.00
- 8K BASIC Interpreter . . . A65-020 \$99.00

POWER SUPPLY SPECIFICATIONS

- +5 VDC \pm 5% regulated @ 2.0 amps (max)
- +24 VDC \pm 15% unregulated @ 2.5 amps (peak)
0.5 amps average

PRICE: \$369.00 (1K RAM) \$419.00 (4K RAM)

Plus \$4.00 UPS (shipped in U.S. must give **street** address), \$10 parcel post to APO's, FPO's, Alaska, Hawaii, Canada, \$25 air mail to all other countries.
AIM 65 USER MANUAL \$5.00 plus \$1.50 shipping & handling.
We manufacture a complete line of high quality expansion boards. Use reader service card to be added to our mailing list, or U.S. residents send \$1.00 (International send \$3.00 U.S.) for airmail delivery of our complete catalog.

 **ENTERPRISES**
INCORPORATED

2967 W. Fairmount Avenue
Phoenix, AZ. 85017
(602)265-7564



Explorer/85

100% compatible with all 8080A and
8085 software & development tools!

No matter what your future computing plans may be, Level "A"—at \$129.95—is your starting point.

Starting at just \$129.95 for a Level "A" operating system, you can now build the exact computer you want. Explorer/85 can be your beginner's system, OEM controller, or IBM-formatted 8" disk small business system...yet you're never forced to spend a penny for a component or feature you don't want and you can expand in small, affordable steps!

Now, for just \$129.95, you can own the first level of a fully expandable computer with professional capabilities—a computer which features the advanced Intel 8085 cpu, thereby giving you immediate access to all software and development tools that exist for both the 8085 and its 8080A predecessor (they are 100% software compatible)—a computer which features on-board S-100 bus expansion—plus instant conversion to mass storage disk memory with either 5-1/4" diskettes or standard IBM-formatted 8" disks.

For just \$129.95 (plus the cost of a power supply, keyboard/terminal and RF modulator, if you don't have them already), Explorer/85 lets you begin computing on a significant level...applying the principles discussed in leading computer magazines...developing "state of the art" computer solutions for both the industrial and leisure environment.

Level "A" Specifications

Explorer/85's Level "A" system features the advanced Intel 8085 cpu, an 8355 ROM with 2k deluxe monitor/operating system, and an 8155 ROM-1/O—all on a single motherboard with room for RAM/ROM/PROM/EPROM and S-100 expansion, plus generous prototyping space.

Level "A" makes a perfect OEM controller for industrial applications and is available in a special Hex Version which can be programmed using the Netronics Hex Keypad/Display.



Level "A" at \$129.95 is a complete operating system, perfect for beginners, hobbiests, or industrial controller use.

...cassette tape recorder output...cassette tape control output...speaker output...LED output indicator on SOD (serial output) line...printer interface (less drivers)...total of four 8-bit plus one 6-bit I/O ports • Crystal Frequency: 6.144 MHz • Control Switches: reset and user (RST 7.5) interrupt...additional provisions for RST 5.5, 6.5 and TRAP interrupts on-board • Counter/Timer: programmable, 14-bit binary • System RAM: 256 bytes located at F800, ideal for smaller systems and for use as an isolated stack area in expanded systems...RAM expandable to 64k via S-100 bus or 4K on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at F000 leaving 0000 free for user RAM/ROM. Features include tape load with labeling...tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address...move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer...serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Version): Tape load with labeling...tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all

By Netronics



registers...single step with register display at each break point...go to execution address. Level "A" in the Hex Version makes a perfect controller for industrial applications and can be programmed using the Netronics Hex Keypad/Display.



Hex Keypad/Display.

Level "B" Specifications

Level "B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards and includes: address decoding for on-board 4k RAM expansion select-able in 4k blocks...address decoding for on-board 8k EPROM expansion select-able in 8k blocks...address and data bus drivers for on-board expansion...wait state generator (jumper select-able), to allow the use of slower memories...two separate 5 volt regulators.



Explorer/85 with Level "B" card cage.

Level "C" includes a sheet metal superstructure, a 5-card gold plated S-100 extension PC board which plugs into the motherboard. Just add required number of S-100 connectors.

Level "D" Specifications

Level "D" provides 4k or RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the original 256 bytes located in the 8155A). The static RAM can be located anywhere from 0000 to EFFF in 4k blocks.

Level "E" Specifications

Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for soon to be available RAM IC's (allowing for up to 12k of on-board RAM).

Order A Coordinated Explorer/85 Applications Pak!

Experimenter's Pak (SAVE \$12.50)—Buy Level "A" and Hex Keypad/Display for \$199.95 and get FREE Intel 8085 user's manual plus FREE postage & handling!

Student Pak (SAVE \$24.45)—Buy Level "A," ASCII Keyboard/Computer Terminal, and Power Supply for \$319.95 and get FREE RF Modulator plus FREE Intel 8085 user's manual plus FREE postage & handling!

Engineering Pak (SAVE \$41.00)—Buy Levels "A," "B," "C," "D," and "E" with Power Supply, ASCII Keyboard/Computer Terminal, and six S-100 Bus Connectors for \$514.75 and get 10 FREE computer grade cassette tapes plus FREE 8085 user's manual plus FREE postage & handling!

Business Pak (SAVE \$89.95)—Buy Explorer/85 Levels "A," "B," and "C" (with cabinet), Power Supply, ASCII Keyboard/Computer Terminal (with cabinet), 16k RAM, 12" Video Monitor, North Star 5-1/4" Disk Drive (includes North Star BASIC) with power supply and cabinet, all for just \$1599.40 and get 10 FREE 5-1/4" minidiskettes (\$49.95 value) plus FREE 8085 user's manual plus FREE postage & handling!

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE 800-243-7428

To Order From Connecticut Or For Technical Assistance, Etc. Call (203) 354-9375



sonalized disk operating system—just plug it in and you're up and running! \$699.95 plus \$5 p&h.

☐ Power Supply Kit for North Star Disk Drive, \$39.95 plus \$2 p&h.

☐ Deluxe Case for North Star Disk Drive, \$39.95 plus \$2 p&h.

☐ Experimenter's Pak (see above), \$199.95 postpaid.

☐ Student Pak (see above), \$319.95 postpaid.

☐ Engineering Pak (see above), \$514.75 postpaid.

☐ Business Pak (see above), \$1599.40 postpaid.

Total Enclosed \$ _____ (Conn. res. add sales tax) By—

☐ Personal Check ☐ M.O./Cashier's Check ☐ Visa ☐ Master Charge

(Bank # _____)

Acct. # _____ Exp. Date _____

Print Name _____

Address _____

City _____

State _____ Zip _____

☐ Send Me Information

By Netronics

ASCII/BAUDOT,
STAND ALONE



Computer Terminal
COMPLETE FOR ONLY \$149.95

The Netronics ASCII/BAUDOT Computer Terminal Kit is a microprocessor-controlled, stand alone keyboard/terminal requiring no computer memory or software. It allows the use of either a 64 or 32 character by 16 line professional display format with selectable baud rate, RS232-C or 20 ma. output, full cursor control and 75 ohm composite video output.

The keyboard follows the standard typewriter configuration and generates the entire 128 character ASCII upper/lower case set with 96 printable characters. Features include on-board regulators, selectable parity, shift lock key, alpha lock jumper, a drive capability of one TTY load, and the ability to mate directly with almost any computer, including the new Explorer/85 and ELF products by Netronics.

The Computer Terminal requires no I/O mapping and includes 1k of memory, character generator, 2 key rollover, processor controlled cursor control, parallel ASCII/BAUDOT to serial conversion and serial to video processing—fully crystal controlled for superb accuracy. PC boards are the highest quality glass epoxy for the ultimate in reliability and long life.

VIDEO DISPLAY SPECIFICATIONS

The heart of the Netronics Computer Terminal is the microprocessor-controlled Netronics Video Display Board (VID) which allows the terminal to utilize either a parallel ASCII or BAUDOT signal source. The VID converts the parallel data to serial data which is then formatted to either RS232-C or 20 ma. current loop output, which can be connected to the serial I/O on your computer or other interface, i.e., Modem.

When connected to a computer, the computer must echo the character received. This data is received by the VID which processes the information, converting to data to video suitable to be displayed on a TV set (using an RF modulator) or on a video monitor. The VID generates the cursor, horizontal and vertical sync pulses and performs the housekeeping relative to which character and where it is to be displayed on the screen.

Video Output: 1.5 P/P into 75 ohm (EIA RS-170) • Baud Rate: 110 and 300 ASCII • Outputs: RS232-C or 20 ma. current loop • ASCII Character Set: 128 printable characters—

0123456789ABCDEF GHIJKLMNOPQRSTUVWXYZ [\] ^ _ ` a b c d e f g h i j k l m n o p q r s t u v w x y z { | } ~

BAUDOT Character Set: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z . , - * / 0 1 2 3 4 5 6 7 8 9

Cursor Modes: Home, Backspace, Horizontal Tab, Line Feed, Vertical Tab, Carriage Return. Two special cursor sequences are provided for absolute and relative X-Y cursor addressing.

Cursor Control: Erase, End of Line, Erase of Screen, Form Feed, Delete • Monitor Operation: 50 or 60Hz (jumper selectable).

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE 800-243-7428

To Order From Connecticut Or For Technical Assistance, Etc. Call (203) 354-9375

Netronics R&D Ltd., Dept. K-1
333 Litchfield Road, New Milford, CT 06776

Please send the items checked below—

- ☐ Netronics Stand Alone ASCII Keyboard/Computer Terminal Kit, \$149.95 plus \$3.00 postage & handling.
- ☐ Deluxe Steel Cabinet (w/ Netronics Keyboard/Terminal In Blue/Black Finish, \$199.95 plus \$2.50 postage and handling.
- ☐ Video Display Board Kit alone (less keyboard), \$89.95 plus \$3 postage & handling.
- ☐ 12" Video Monitor (10 MHz bandwidth) fully assembled and tested, \$139.95 plus \$5 postage and handling.
- ☐ RF Modulator Kit (to use your TV set for a monitor), \$89.95 postpaid.
- ☐ 5 amp Power Supply Kit In Deluxe Steel Cabinet (±8VDC @ 5 amps, plus 6-8 VAC), \$39.95 plus \$2 postage & handling.

Total Enclosed (Conn. res. add sales tax) \$ _____

By—

☐ Personal Check ☐ Cashiers Check/Money Order ☐ Visa ☐ Master Charge (Bank # _____)

Acct. # _____ Exp. Date _____

Signature _____

Print Name _____

Address _____

City _____

State _____ Zip _____

☐ Send Me More Information

Netronics R&D Ltd., Dept. K-1
333 Litchfield Road, New Milford, CT 06776

Please send the items checked below—

- ☐ Explorer/85 Level "A" Kit (ASCII Version), \$129.95 plus \$3 p&h.
- ☐ Explorer/85 Level "A" Kit (Hex Version), \$129.95 plus \$3 p&h.
- ☐ 8k Microsoft BASIC on cassette tape, \$64.95 postpaid.
- ☐ 8k Microsoft BASIC in ROM Kit (requires Levels "B," "D," and "E"), \$99.95 plus \$2 p&h.
- ☐ Level "B" (S-100) Kit, \$49.95 plus \$2 p&h.
- ☐ Level "C" (S-100 6-card expander) Kit, \$39.95 plus \$2 p&h.
- ☐ Level "D" (4k RAM) Kit, \$69.95 plus \$2 p&h.
- ☐ Level "E" (EPROM/ROM) Kit, \$69.95 plus \$2 p&h.
- ☐ Deluxe Steel Cabinet for Explorer/85, \$49.95 plus \$3 p&h.
- ☐ ASCII Keyboard/Computer Terminal Kit (features a full 128 character set, upper & lower case, full cursor control, 75 ohm video output convertible to baudot output, selectable baud rate, RS232-C or 20 ma. I/O, 32 or 64 character by 16 line formats, and can be used with either a CRT monitor or a TV set (if you have an RF modulator), \$149.95 plus \$2.50 p&h.
- ☐ Hex Keypad/Display Kit, \$69.95

plus \$2 p&h.

☐ Deluxe Steel Cabinet for ASCII Keyboard/Terminal, \$199.95 plus \$2.50 p&h.

☐ Power Supply Kit (±8V @ 5 amps) in deluxe steel cabinet, \$39.95 plus \$2 p&h.

☐ Gold Plated S-100 Bus Connectors, \$4.85 each, postpaid.

☐ RF Modulator Kit (allows you to use your TV set as a monitor), \$89.95 postpaid.

☐ 16k RAM Kit (S-100 Board expands to 64k), \$199.95 plus \$2 p&h.

☐ 32k RAM Kit, \$329.95 plus \$2 p&h.

☐ 48k RAM Kit, \$459.95 plus \$2 p&h.

☐ 64k RAM Kit, \$689.95 plus \$2 p&h.

☐ 16k RAM Expansion Kit (to expand any of the above up to 64k), \$139.95 plus \$2 p&h each.

☐ Intel 8085 cpu User's Manual, \$7.50 postpaid.

☐ Special Computer Grade Cassette Tapes, \$1.90 each or 3 for \$5, postpaid.

☐ 12" Video Monitor (10 MHz bandwidth), \$139.95 plus \$5 p&h.

☐ North Star Double Density Floppy Disk Kit (One Drive) for Explorer/85 (includes 3 drive S-100 controller, DOS, and extended BASIC with per-

encyclopedia of microcomputing

4,600 pages



That's the size of the world's most comprehensive guide to microcomputing. Over 2 years of Kilobaud Microcomputing . . . a virtual expanding encyclopedia of computing.

Back issues of Kilobaud Microcomputing are a gold mine of interesting articles. There's little to go stale in microcomputing . . . software, applications, great editorials. Start your encyclopedia today by sending for our FREE KB Microcomputing Back Issues Catalog. You'll see every issue available with descriptions of each issue. Pick your favorites or get them all.

☐ YES! Rush me Microcomputing's FREE Back Issues Catalog!

Name

Address

City State Zip

kilobaud

MICROCOMPUTING T.M.

Peterborough NH 03458

Dept. KB

Dennis Tedd Wayne Tami John
 HAPPY NEW YEAR
 from the staff of Microcomputing™
 Sue G. Off Klin BAH Pat
 Ken The Rock J White

MOVING?

Let us know 8 weeks in advance so that you won't miss a single issue of *Kilobaud Microcomputing*. Attach old label where indicated and print new address in space provided. Also include your mailing label whenever you write concerning your subscription. It helps us serve you promptly.

- ☐ Address change only ☐ Payment enclosed
☐ Extend subscription ☐ Bill me later
☐ Enter new subscription
☐ 1 year \$18.00

If you have no label handy, print OLD address here.

NAME _____ CALL _____
 ADDRESS _____
 CITY _____ STATE _____ ZIP _____

print NEW address here:

NAME _____ CALL _____
 ADDRESS _____
 CITY _____ STATE _____ ZIP _____

Kilobaud Microcomputing P.O. Box 997 • Farmingdale NY 11737

is HARD COPY STORAGE a problem?

KILOBAUD MICROCOMPUTING, as thick as it is, is more like a floppy when it comes to standing on the bookshelf. Try the **KILOBAUD MICROCOMPUTING Library Shelf Boxes**... sturdy corrugated white dirt-resistant cardboard boxes which will keep them from flopping around. We have self-sticking labels for the boxes, too, not only for **KILOBAUD MICROCOMPUTING**, but also for **73 Magazine**, **80 MICROCOMPUTING**... and for **CQ**, **QST**, **Ham Radio**, **Personal Computing**, **Radio Electronics**, **Interface Age**, and **Byte**. Ask for whatever stickers you want with your box order. They hold a full year of **KILOBAUD MICROCOMPUTING**, **80 MICROCOMPUTING**... or **73 Magazine**. Your magazine library is your prime reference; keep it handy and keep it neat with these strong library shelf boxes. One box (BX-1000) is \$2.00, 2-7 boxes (BX-1001) are \$1.50 each, and eight or more boxes (BX-1002) are \$1.25 each. Be sure to specify which labels we should send. Have your credit card handy and call our toll-free order number 800-258-5473, or use the order card in the back of the magazine and mail to:

kilobaud™
MICROCOMPUTING
 peterborough nh 03458



Kilobaud
MICROCOMPUTING

BINDERS

Keep your library of Kilobaud MICROCOMPUTING from loss or damage in these handsomely appointed binders with rich blue covers and gold lettering. Each binder holds 12 issues, making an **EXCELLENT REFERENCE HANDBOOK**. Several binders form a quality library you can be proud of.

Order yours today...

only \$6.50 each (BN1011)... 2 for \$12.00 (BN1012)

Use the order card in the back of this magazine or itemize your order on a separate piece of paper and mail to:

MICROCOMPUTING BINDERS • PETERBOROUGH NH 03458

Be sure to include check or detailed credit card information.

kb microcomputing book nook

● **HOBBY COMPUTERS ARE HERE!**—BK7322—If you want to come up to speed on how computers work . . . hardware and software . . . this is an excellent book. It starts with the fundamentals and explains the circuits, the basics of programming, along with a couple of TVT construction projects, ASCII-Baudot, etc. This book has the highest recommendations as a teaching aid for newcomers. \$4.95.*

● **THE NEW HOBBY COMPUTERS**—BK7340—This book takes it from where *Hobby Computers Are Here!* leaves off, with chapters on Large Scale Integration, how to choose a microprocessor chip, an introduction to programming, low cost I/O for a computer, computer arithmetic, checking memory boards, a Baudot monitor/editor system, an audible logic probe for finding those tough problems, a ham's computer, a computer QSO machine . . . and much, much more! \$4.95*

● **INTRODUCTION TO MICROPROCESSORS**—BK1032—by Charles Rockwell of MICROLOG, is an ideal reference for the individual desiring to understand the hardware aspects of microprocessor systems. Describes the hardware details of computer devices in terms the beginner can understand, instead of treating the micro chip as a "black box." Specific systems are not described and programming is only briefly discussed. \$17.50 U.S. and Canada; \$20 elsewhere.*

● **BASIC NEW 2ND EDITION**—BK1081—by Bob Albrecht. Self-teaching guide to the computer language you will need to know for use with your microcomputer. This is one of the easiest ways to learn computer programming. \$5.95.*

● **SCIENTIFIC RESEARCH INSTRUMENT'S BASIC SOFTWARE LIBRARY** is a complete do-it-yourself kit, written in everybody's BASIC, immediately executable in ANY computer with 8K; no other peripherals needed. **Volume I** contains business and recreational programs and is 300 pages. **Volume II** is 260 pages and contains math, engineering, statistics and plotting programs. **Volume III** contains money management, advanced business programs such as billing, A/R, inventory, payroll, etc. **Volume IV** contains general purpose programs such as loans, rates, retirement, plus games: Poker, Enterprise (take charge while Capt. Kirk is away), Football and more! **Volume V** is filled with experimenters' programs, including games, pictures and misc. problems such as "logic." **Volume VI** is a miniature business system; and **Volume VII** contains professional programs. **Volume I**—LB1002—& **Volume II**—LB1003—\$24.95* each, **Volume III**—LB1004—\$39.95*, **Volume IV**—LB1005—& **Volume V**—LB1006—\$9.95* each, **Volume VI**—LB1005—\$49.95*, **Volume VII**—LB1008—\$39.95.*

● **MICROPROCESSOR INTERFACING TECHNIQUES**—BK1037—by Austin Lesea & Rodney Zaks will teach you how to interconnect a complete system and interface it to all the usual peripherals. It covers hardware and software skills and techniques, including the use and design of model buses such as the IEEE 488 or S100. \$13.95.*

● **TTL COOKBOOK**—BK1063—by Donald Lancaster. Explains what TTL is, how it works, and how to use it. Discusses practical applications, such as a digital counter and display system, events counter, electronic stopwatch, digital voltmeter and a digital tachometer. \$9.50.

● **CMOS COOKBOOK**—BK1011—by Don Lancaster. Details the application of CMOS, the low power logic family suitable for most applications presently dominated by TTL. Required reading for every serious digital experimenter! \$10.50.*

● **TVT COOKBOOK**—BK1064—by Don Lancaster. Describes the use of a standard television receiver as a microprocessor CRT terminal. Explains and describes character generation, cursor control and interface information in typical, easy-to-understand Lancaster style. \$9.95.*

● **THE "COMPULATOR" BOOK—BUILDING SUPER CALCULATORS & MINICOMPUTER HARDWARE WITH CALCULATOR CHIPS**—BK1012—by R.P. Haviland, provides ideas, design info and/or printed circuit boards for calculator chip projects such as tape control of calculator electronic lock, dial-a-telephone, etc. \$7.95.*

● **BASIC COMPUTER GAMES**—BK1074—Okay, so once you get your computer and are running in BASIC, then what? Then you need some programs in BASIC, that's what. This book has 101 games for you from very simple to real buggers. You get the games, a description of the games, the listing to put in your computer and a sample run to show you how they work. Fun. Any one game will be worth more than the price of the book for the fun you and your family will have with it. \$7.50.*

● **WHAT TO DO AFTER YOU HIT RETURN**—BK1071—PCC's first book of computer games . . . 48 different computer games you can play in BASIC . . . programs, descriptions, many illustrations. Lunar Landing, Hammurabi, King, Civel 2, Qubic 5, Taxman, Star Trek, Crash, Market, etc. \$10.95.*

● **MICROCOMPUTING CODING SHEETS** *Microcomputing's* dozen or so programmers wouldn't try to work without these handy scratch pads, which help prevent the little errors that can cost hours and hours of programming time. Available for programming is **Assembly/Machine Language** (PD1001), which has columns for address, instruction (3 bytes), source code (label, op code, operand) and comments; and for **BASIC** (PD1002) which is 72 columns wide. 50 sheets to a pad. \$2.39.*

*Use the order card in the back of this magazine or itemize your order on a separate piece of paper and mail to:
Kilobaud Microcomputing Book Department • Peterborough NH 03458. Be sure to include check or detailed credit card information.
All orders, add \$1.00 handling.

FOR TOLL FREE ORDERING CALL 1-800-258-5473

kb microcomputing book nook

● **PROGRAMMING IN PASCAL**—BK1140—by Peter Grogono. The computer programming language PASCAL was the first language to embody in a coherent way the concepts of structured programming, which has been defined by Edsger Dijkstra and C.A.R. Hoare. As such, it is a landmark in the development of programming languages. PASCAL was developed by Niklaus Wirth in Zurich; it is derived from the language ALGOL 60 but is more powerful and easier to use. PASCAL is now widely accepted as a useful language that can be efficiently implemented, and as an excellent teaching tool. It does not assume knowledge of any other programming language; it is therefore suitable for an introductory course. \$9.95.*

● **MICROPROCESSOR LEXICON—ACRONYMS AND DEFINITIONS**—BK1137—compiled by the staff of SYBEX, is a convenient reference in pocket-size format. Sections include acronyms and definitions, part numbers and their definitions, S-100 signals; RS232 signals, IEEE 499 signals, microcomputers and microprocessors, JETDS summary (military) and a code conversion table. \$2.95.*

● **INSTANT BASIC**—BK1131—by Jerald R. Brown. For the personal computer enthusiast or the user of DEC's BASIC PLUS language, here is a new book to teach you BASIC. It teaches BASIC to beginners using interesting programming ideas and applications that will be easily understood by the home computer programmer. BASIC PLUS users know that the two languages are very similar, so this book can be used by them as well. This is an "active participation" workbook, designed to be used with your home computer so you can learn by doing! Ideas are slowly introduced in a nonmathematical context so the beginner can quickly learn good programming techniques. \$6.00.*

● **MY COMPUTER LIKES ME... WHEN I SPEAK BASIC**—BK1039—An introduction to BASIC... simple enough for kids. If you want to teach BASIC to anyone quickly, this is the way to go. \$2.00.*

● **COMPUTER PROGRAMMING HANDBOOK**—BK1014—by Peter Stark. A complete guide to computer programming and data processing. Includes many worked-out examples and history of computers. \$9.95.*

● **MICROCOMPUTER DICTIONARY**—BK1034—This microcomputer dictionary fills the need to become quickly acquainted with the terminology and nomenclature of the revolution in computers. There is also a comprehensive electronics/computer abbreviations and acronyms section. \$15.95.*



● **YOUR HOME COMPUTER**—BK1172—by James White, is an introduction to the world of personal microcomputing. This book tells you everything you want to know about home computing and gives the computer novice a painless introduction to microcomputer technology and terminology, beginning with what computers are and how they work. This basic book requires no prior knowledge or experience in electronics or computing. It provides information about home computer kits; guidelines for selecting and building your own microcomputer, how to use your home computer and what you can do with it; lists of computer stores, clubs, periodicals; and answers to many more of your questions about microcomputers and the jargon surrounding the personal computing scene today. \$6.00.*

● **HOW TO BUILD A MICROCOMPUTER—AND REALLY UNDERSTAND IT**—BK7325—by Sam Creason. The electronics hobbyist who wants to build his own microcomputer system now has a practical "How-To" guidebook. This book is a combination technical manual and programming guide that takes the hobbyist step-by-step through the design, construction, testing and debugging of a complete microcomputer system. Must reading for anyone desiring a true understanding of small computer systems. \$9.95.*

● **THE BASIC HANDBOOK**—BK1174—by David Lien. This book is unique. It is a virtual ENCYCLOPEDIA of BASIC. While not favoring one computer over another, it explains over 250 BASIC words, how to use them and alternate strategies. If a computer does not possess the capabilities of a needed or specified word, there are often ways to accomplish the same function by using another word or combination of words. That's where the HANDBOOK comes in. It helps you get the most from your computer, be it a "bottom-of-the-line" micro or an oversized monster. \$14.95.*

● **MICROCOMPUTER PRIMER**—BK1035—by M. Waite and M. Pardee. Describes basic computer theory, explains numbering systems and introduces the reader to the world of programming. Describes the world of microcomputing in "real world" terminology. \$7.95.*

● **THE STORY OF COMPUTERS**—BK1056—by Donald D. Spencer, is to computer books what *Dick and Jane* is to novels... elementary, gives the non-computerist a fair idea of what the hobbyist is talking about when he speaks computer lingo. Attempts to explain what computers are and can do to a spouse, child or any non-electronics-minded friend. \$4.95.*

*Use the order card in the back of this magazine or itemize your order on a separate piece of paper and mail to:
Kilobaud Microcomputing Book Department • Peterborough NH 03458. Be sure to include check or detailed credit card information.
All orders, add \$1.00 handling.

FOR CUSTOMER SERVICE CALL 603-924-7298

kb microcomputing book nook

NEW ADDITIONS

● **PROGRAMMING THE 6502**—BK1005—Rodnay Zaks has designed a self-contained text to learn programming, using the 6502. It can be used by a person who has never programmed before, and should be of value to anyone using the 6502. The many exercises will allow you to test yourself and practice the concepts presented. \$11.95.*

● **6502 APPLICATIONS BOOK**—BK1006—Rodnay Zaks presents practical-application techniques for the 6502 microprocessor, assuming an elementary knowledge of microprocessor programming. You will build and design your own domestic-use systems and peripherals. Self-test exercises included. \$12.95.*

● **HOW TO SELL ANYTHING TO ANYBODY**—BK7306—According to *The Guinness Book of World Records*, the author, Joe Girard, is "the world's greatest salesman." This book reveals how he made a fortune—and how you can, too. \$2.25.*

● **PIMS: PERSONAL INFORMATION MANAGEMENT SYSTEM**—BK1009—Learn how to unleash the power of a personal computer for your own benefit in this ready-to-use data-base management program. \$9.95.*

● **LOW-COST, PERSONAL COMPUTER-BASED INVESTMENT DECISION SYSTEMS**—BK1101—Use this guidebook by Man-Computer Systems, Inc.'s president, Jerry Felsen, to develop inexpensive personal computer systems that can help you make better investment decisions. \$15.00.*

● **6800 SOFTWARE GOURMET GUIDE AND COOKBOOK**—BK1075—Like its culinary cousin, *The 8080 Gourmet Guide*, this new book by Scelbi Computing and Robert Findley describes sorting, searching and other routines—this time for the 6800 user. \$10.95.*

● **8080 SOFTWARE GOURMET GUIDE AND COOKBOOK**—BK1102—If you have been spending too much time developing simple routines for your 8080, try this new book by Scelbi Computing and Robert Findley. Describes sorting, searching, and many other routines for the 8080 user. \$10.95.*

● **HOW TO MAKE MONEY WITH COMPUTERS**—BK1003—In 10 information-packed chapters, Jerry Felsen describes more than 30 computer-related, money-making, high profit, low capital investment opportunities. \$15.00.*

● **ADD 'N STAC**—BX1003—If you've got programs lying around and want them organized in easy-to-locate fashion Add 'N Stac is the answer. Each unit stores eight cassettes. Each module locks together with the next and grows with your collection. Build yourself a software library with Add 'N Stac by ordering from the Book Nook. As your library grows you'll need more of these handy units so order more than one today. Several colors are available and you can mount them to your wall, desk, table or keep them loose for taking with you. Colors and prices are: Smoke \$3.00*; Black, Dark Blue, Orange, Brown, White, Red \$2.50.*



*Use the order card in the back of this magazine or itemize your order on a separate piece of paper and mail to:
Kilobaud Microcomputing Book Department • Peterborough NH 03458. Be sure to include check or detailed credit card information.
All orders, add \$1.00 handling.

FOR TOLL FREE ORDERING CALL 1-800-258-5473

kb microcomputing book nook

● **AN INTRODUCTION TO MICROCOMPUTERS, VOL. 0**—BK1130—The Beginner's Book—Written for readers who know nothing about computers—for those who have an interest in how to use computers—and for everyone else who must live with computers and should know a little about them. The first in a series of 4 volumes, this book will explain how computers work and what they can do. Computers have become an integral part of life and society. During any given day you are affected by computers, so start learning more about them with Volume 0. \$7.95.*

● **VOL. I**—BK1030—Dedicated to the basic concepts of microcomputers and hardware theory. The purpose of Volume I is to give you a thorough understanding of what microcomputers are. From basic concepts (which are covered in detail), Volume I builds the necessary components of a microcomputer system. This book highlights the difference between minicomputers and microcomputers. \$8.50.*

● **VOL. II**—BK1031 (loose leaf)—\$25.00*; BK1040 (with binder)—\$30.00*—Contains descriptions of individual microprocessors and support devices used only with the parent microprocessor. Volume II describes all available chips.

● **VOL. III**—BK1132 (loose leaf)—\$15.00*; BK1133 (with binder)—\$20.00*—Contains descriptions of all support devices that can be used with any microprocessor.

● **FUN WITH COMPUTERS AND BASIC**—BK1021—by Donald D. Spencer, contains an easy-to-understand explanation of the BASIC Programming Language and is intended for persons who have had no previous exposure to computer programming. Over half the book is devoted to problems using games, puzzles, and mathematical recreations. A superior book for self-teaching and learning computer programming. \$6.95.*



● **ADVANCED BASIC**—BK1000—Applications and problems by James Coan is for those who want to extend their expertise with BASIC. Offers advanced techniques and applications. \$15.00.*

● **PAYROLL WITH COST ACCOUNTING—IN BASIC**—BK1001—by L. Poole & M. Borchers, includes program listings with remarks, descriptions, discussions of the principle behind each program, file layouts, and a complete user's manual with step-by-step instructions, flowcharts, and simple reports and CRT displays. Payroll and cost accounting features include separate payrolls for up to 10 companies, time-tested interactive data entry, easy correction of data entry errors, job costing (labor distribution), check printing with full deduction and pay detail, and 16 different printed reports, including W-2 and 941. \$15.00.*

● **SOME COMMON BASIC PROGRAMS**—BK1053—published by Adam Osborne & Associates, Inc. Perfect for non-technical computerists requiring ready-to-use programs. Business programs, plus miscellaneous programs. Invaluable for the user who is not an experienced programmer. All will operate in the stand-alone mode. \$9.50 paperback.*

● **THE SECRET GUIDE TO COMPUTERS** Parts 1, 2 and 3 by Russ Walter. **Part One** describes computers in general, and after reading for ten minutes you will be writing simple BASIC programs! **Part Two** discusses computer applications. It's one thing to master the syntax of the language such as BASIC and another to solve problems using the new tool. **Part Three** describes programming languages. Ever heard of APL and QLISP? BASIC is not the only language used to program computers. 7th Edition. Part I—BK1050—\$2.75*; Part II—BK1051—\$2.50*; Part III—BK1052—\$3.50.*

*Use the order card in the back of this magazine or itemize your order on a separate piece of paper and mail to: Kilobaud Microcomputing Book Department • Peterborough NH 03458. Be sure to include check or detailed credit card information. All orders, add \$1.00 handling.

KB BOOK NOOK ORDER FORM

Qty.	Cat. #	Description	Unit Price	Total

Add \$1.00 Handling:

Total:

Enclosed \$ ☐ Check ☐ Money Order

☐ Master Charge ☐ VISA ☐ American Express

Credit card # _____ Exp. date _____ Signature _____

Name _____

Address _____

City _____ State _____ Zip _____

Coupon expires in 60 days

Kilobaud
MICROCOMPUTING T.M.
Peterborough NH 03458

FOR CUSTOMER SERVICE CALL 603-924-7298

MICROCOMPUTING T.M. LIST OF ADVERTISERS

A90 Aardvark Technical Serv. 96, 161	H49 Heath Co. 73	P63 Parasitic Engineering. 168
A112 The Abacus. 114	H25 Hobby World. 195	P7 Percom Data Co., Inc. CII
A88 A B Computers. 161	H45 Houston Micro-Computer Tech., Inc. 49	P82 Percom Data Co., Inc. 23
A75 AGS Service. 82, 129	H47 Hubert Howe (Howe Software) 156	P67-P71 Percom Data Co., Inc. 24, 25
A38 Advanced Comp. Products. 207	I47 Ian Electronics. 161	P83 Percom Data Co., Inc. 188
A102 Adventure International. 156	I24 Innovative Technology. 192	P52 The Peripheral People. 162
A101 Alpha Byte Storage. 184, 190	I32 Instant Software. 120-125	C139 Personal Software. CIII
A111 Alphatecs. 139	I13 Integrant. 148	P60 Practical Applications. 155
A66 American Square Computers. 194	I50 Interactive Microwave, Inc. 169	P21 Priority One. 200-202
A98 Bill Archbold. 96	I49 Interactive Structures, Inc. 22	P48 Programma International, Inc. 45
A114 Atari Personal Comp. Sys. 4	I21 Intertec Data Systems. 3, 20	Q12 Quality Software. 166
A115 Audio Video Systems. 190	* Ithaca Intersystems, Inc. 35, 185	Q8 Quant Systems. 88
A71 Automated Simulations. 31	I46 Iridis. 88	Q9 Quasar Data Products. 105
B50 Bluebird's Inc. 141	J6 Jade Computer Prod. 208, 209	Q3 Quest Electronics. 203
B33 The Bottom Shelf, Inc. 93, 133	J1 Jameco Electronics. 214, 215	R24 Racet Computes. 176
C128 Cecdat, Inc. 30, 179	J13 J.E.S. Graphics. 192	R11 Radio Hut. 210
C170 Centuri, Recording Studio, Inc. 184	J12 JPC Products. 186	* Radio Shack. 197
C180 CFR Associates. 194	K14 Key Electronics. 138	R34 Radio Shack Authorized Sales Center. 131
C116 CGRS Microtech. 184	L27 Lake City Technical Products 179	* Rainbow Computing, Inc. 61
C172 Checks To Go. 73	L3 Dr. Lee. 101, 189	R8 Ramsey Electronics. 162, 163
C159 Compro. 166	L19 Level IV Products, Inc. 187	* Realty Software Co. 187, 189
C122 CompuCover. 178	* Lifeboat Associates. 75, 189	* Recreational Program. 89
C109 CompuSoft Publishing. 177	L25 The Logic Store. 184	R20 RNB Enterprises. 218
C173 Compute. 158	M124 MaCo Manufacturing. 158	R7 Rondure Company. 193
C171 Computer Center. 190	M77 Madhatter Software. 83	S129 SC Digital. 158
C108 Computer City. 113	M121 Management Informa. Spec. 192	S16 Selectronics. 206
C167 Computer Concepts. 139	M119 Med Systems. 114	S127 Lear Siegler/Data Products-Div. 20
C64 Computer Corner of NJ. 184	* Micro Applications Group. 30, 48	S121 Simutek. 159
C175 Computer Data Services. 192	M82 MicroComputer Tech/Apparat 196	S113 Sirius Systems. 34
C156 Computer Design Labs. 97	M110 MicroDaSys. 21, 186	S95 Small Business Computer Service 190
C111 Computer Forum. 142	M116 Micro Discount Service. 192	S51 Small Systems Software. 41
C104 Computer Information Exchg. 156	M112 Micro Innovations. 161	S90 Softape. 132
C168 Computer Shopper. 119	M73 Micromall. 177	S123 Solaris Press. 176
C147 The Computer Stop. 155	M95 Micro Management Systems. 159	S128 Structured Program Designers 187
C174 Computer Specialties. 178	M105 Micro Matrix. 167	S126 Sun-Technology, Inc. 22, 185
C86 Computrex. 63	M126 Micromint. 163	S61 Supersoft. 118
C114 Computronics. 55	M115 Micron. 101	T37 Tano Corp. 77
C108 The CPU Shop. 113	M125 Micro Phase Systems. 190	T57 Taranto & Associates. 73
C169 Creative Computing. 109	M81 Micro Products Unltd. 192	T11 Tarbell Electronics. 21
C123 Cuddly Software. 139	M67 Microsette. 96, 138	T74 Technology Marketing Analysis Corp. 59
C132 Custom Electronics, Inc. 184	M44 Micro Technology Unltd. 20, 80	T26 Telecommunications Serv. 190
* Cybernetics, Inc. 156	M108 Microtel, Inc. 163	T56 TNW Corp. 22, 88, 184
D43 Dr. Daley. 168	M127 Microwave Associates, Inc. 179	T69 TYC Software. 189
D50 Data/Print. 89, 167	M94 Mid East Micro. 154	* Tora Systems Limited. 154
D40 Datasearch. 142	M106 Midwest Comp. Peripherals. 179	T41 Total Information Services. 169
D65 Datasouth Computer Corp. 156	M70 Midwest Scientific. CIV	T75 Total Information Services. 189
D72 D C software & Comp. Products 166	M39 Mikos. 217	T46 Transition Enterprises, Inc. 169
D61 Delta Systems. 185	M114 Miller Microcomputer Serv. 161	U14 UHF Associates. 19
D28 Deltroniks. 194	M6 Mini Micro Mart. 204, 205	U12 Ultimate Computer Systems. 96
D47 Designco. 186	M32 Mullen Computer Boards. 131	V8 Vector Electronic Co. Inc. 21
D70 D-G Electronic Developments Co. 20	M83 Multi-Business Comp. Sys. 143	V28 VR Data Corporation. 142, 143
D63 Digital Marketing. 61	* Mumford Micro Systems. 48	* Wallen Electronics. 211
* Digital Research Computers. 212	* National Radio Institute. 157	W22 Wameco, Inc. 217
* Digital Research Parts. 175	N12 NEECO. 191	W20 WEB Associates. 165
D60 Digital Video Systems. 192	N15 Netronics R&D Ltd. 139, 219	W29 West Side Electronics. 132
D69 Disco-Tech. 188	N7 Newman Computer Exchg. (CompuMart). 213	W36 Will Serve Industries. 114
D71 D & R Creative Sys. 190	N29 North Star Synergistics. 159	W16 World Wide Electronics. 138
D67 Dwo Quong Fok Lok Sow. 154	O13 Ohio Scientific. 10-13	X4 Xitex Corp. 65
E34 Ecosoft. 118	O5 OK Machine & Tool. 149	Y3 Your Own Computer, Ltd. 190
E37 80-Us Journal. 143	O18 Omnitek Systems. 141, 192	From Kilobaud. 67-69, 186, 220-226
E18 Electravalue Industrial. 190	O2 On-Line. 132	From 80 Microcomputing. 115
E36 Electronics Specialists, Inc. 161	O10 Optimal Technology, Inc. 131, 155	
E21 Electronics Systems. 198, 199	O14 Organic Software. 189	
E56 Essex Publishing Co. 192	O8 Orthon Computers. 96	
E48 Exatron. 81	O9 Otto Electronics. 155	
F20 Fuller Software. 101	P66 Pacific Exchanges. 96	
G34 Allen Gelder. 194	P9 PAIA. 21, 167, 169	
G28 Gimix, Inc. 162		
G4 Godbout Electronics. 216		

*Reader Service inquiries not honored. Please contact advertiser directly.

READER SERVICE

To receive more information from any of the advertisers in this issue of Kilobaud **Microcomputing**, postage-paid return cards are provided here for your convenience. If you wish to hear from one or several advertisers, refer to the ad itself. You will find numbers near the logo of each advertiser. Each represents the advertiser's individual **Reader Service** number. Circle the corresponding numbers on one of the cards on this page, include your name, address & zip and drop in a mailbox. In four to six weeks you'll hear from the advertiser directly.

Kilobaud MICROCOMPUTING READER SERVICE CARD

Return this card to receive full information on the many products advertised in this issue. Limit: 25 requests.

☐ Subscriber. ☐ Newsstand. This card is valid until February 29, 1980.

A38	A114	C116	C168	D47	E21	H45	J1	M39	M105	M125	O10	P66	Q12	S90	T41	W16
A66	A115	C122	C169	D50	E34	H47	J6	M44	M106	M126	O13	P67	R7	S95	T46	W20
A71	B33	C123	C170	D60	E36	H49	J12	M67	M108	M127	O14	P68	R8	S113	T56	W22
A75	B50	C128	C171	D61	E37	I13	J13	M70	M110	N7	O18	P69	R11	S121	T57	W29
A88	C64	C132	C172	D63	E48	I21	K14	M73	M112	N12	P7	P70	R20	S123	T69	W36
A90	C86	C139	C173	D65	E56	I24	L3	M77	M114	N15	P9	P71	R24	S126	T74	X4
A98	C104	C147	C174	D67	F20	I32	L19	M81	M115	N29	P21	P82	R33	S127	T75	Y3
A101	C108	C156	C175	D69	G4	I46	L25	M82	M116	O2	P48	P83	R34	S128	U12	
A102	C109	C159	D28	D70	G28	I47	L27	M83	M119	O5	P52	Q3	S16	S129	U14	
A111	C111	C160	D40	D71	G34	I49	M6	M94	M121	O8	P60	Q8	S51	T26	V8	
A112	C114	C167	D43	E18	H25	I50	M32	M95	M124	O9	P63	Q9	S61	T37	V28	

I own a: ☐ TRS-80 ☐ PET ☐ Apple Other: _____

This month's **ARTICLE WINNER** (title page number): _____

Name _____
(PLEASE TYPE OR PRINT CLEARLY)

Address _____

City _____ State _____ Zip _____

KB 1/80



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud

MICROCOMPUTING T.M.

Peterborough NH 03458

Att: Mail Order

Kilobaud MICROCOMPUTING READER SERVICE CARD

Return this card to receive full information on the many products advertised in this issue. Limit: 25 requests.

☐ Subscriber. ☐ Newsstand. This card is valid until February 29, 1980.

A38	A114	C116	C168	D47	E21	H45	J1	M39	M105	M125	O10	P66	Q12	S90	T41	W16
A66	A115	C122	C169	D50	E34	H47	J6	M44	M106	M126	O13	P67	R7	S95	T46	W20
A71	B33	C123	C170	D60	E36	H49	J12	M67	M108	M127	O14	P68	R8	S113	T56	W22
A75	B50	C128	C171	D61	E37	I13	J13	M70	M110	N7	O18	P69	R11	S121	T57	W29
A88	C64	C132	C172	D63	E48	I21	K14	M73	M112	N12	P7	P70	R20	S123	T69	W36
A90	C86	C139	C173	D65	E56	I24	L3	M77	M114	N15	P9	P71	R24	S126	T74	X4
A98	C104	C147	C174	D67	F20	I32	L19	M81	M115	N29	P21	P82	R33	S127	T75	Y3
A101	C108	C156	C175	D69	G4	I46	L25	M82	M116	O2	P48	P83	R34	S128	U12	
A102	C109	C159	D28	D70	G28	I47	L27	M83	M119	O5	P52	Q3	S16	S129	U14	
A111	C111	C160	D40	D71	G34	I49	M6	M94	M121	O8	P60	Q8	S51	T26	V8	
A112	C114	C167	D43	E18	H25	I50	M32	M95	M124	O9	P63	Q9	S61	T37	V28	

I own a: ☐ TRS-80 ☐ PET ☐ Apple Other: _____

This month's **ARTICLE WINNER** (title page number): _____

Name _____
(PLEASE TYPE OR PRINT CLEARLY)

Address _____

City _____ State _____ Zip _____

KB 1/80

kilobaud
MICROCOMPUTING T.M.



BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud

MICROCOMPUTING^{T.M.}

peterborough nh 03458

ATTN: READER SERVICE

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



kilobaud
MICROCOMPUTING^{T.M.}
books, etc.

BOOK NOOK ORDER FORM

Please send me the following **Microcomputing** products: (please print or type!)

Qty.	Catalog #	Description	Unit Price	Total
Add \$1.00 Handling:				
Total:				

Enclosed \$ _____ ☐ Check ☐ Money order

Bill: ☐ American Express ☐ Visa ☐ MasterCharge

Credit Card # _____

Expiration date _____ Signature _____

Name _____

Address _____

City _____ State _____ Zip _____



BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 17 PETERBOROUGH NH 03458

POSTAGE WILL BE PAID BY ADDRESSEE

kilobaud

MICROCOMPUTING^{T.M.}

peterborough nh 03458

ATTN: READER SERVICE

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



KB 1/80

BX1003 Add 'n Stac — \$2.50
BK1000 Advanced BASIC — \$15.00
BK1074 BASIC Computer Games — \$7.50
BK1081 BASIC New 2nd Edition — \$5.95
BK1174 The BASIC Handbook — \$14.95
BN1011 Binder — KB-1 — \$6.50
BN1012 Binder — KB-2 & up — 6.00 ea.
BK1011 CMOS Cookbook — \$10.50
BK1012 The "Compulator" Book — Building Super Calculators & Minicomputer Hardware With Calculator Chips — \$7.95
BK1014 Computer Programming Handbook — \$9.95
BK1102 8080 Software Gourmet Guide & Cookbook — \$10.95
BK1021 Fun With Computers & BASIC — \$6.95
BK7322 Hobby Computers Are Here! — \$4.95
BK7325 How to Build a Microcomputer — \$9.95
BK1003 How To Make Money With Computers — \$15.00
BK7306 How To Sell Anything To Anybody — \$2.25
BK1131 Instant BASIC — \$6.00
Introduction to Microcomputers
BK1130 Vol. 0 — \$7.95;
BK1030 Vol. I — \$9.50;
BK1031 Vol. II (loose leaf) — \$25.00;
BK1040 Vol. II (with binder) — \$30.00;
BK1132 Vol. III (loose leaf) — \$15.00;
BK1133 Vol. III (with binder) — \$20.00
BK1032 Introduction to Microprocessors — \$17.50 USA; \$20 Elsewhere
Kilobaud Coding Sheets PD1001 — Assembly/Machine Language — \$2.39;
PD1002 — BASIC — \$2.39
BK1101 — Low-Cost, Personal Computer-Based Investment Decision Systems — \$15.00
BK1034 Microcomputer Dictionary — \$15.95
BK1035 Microcomputer Primer — \$7.95
BK1037 Microprocessor Interfacing Techniques — \$13.95
BK1137 Microprocessor Lexicon — Acronyms and Definitions — \$2.95
BK1039 My Computer Likes Me... When I Speak BASIC — \$2.00
BK7340 The New Hobby Computers — \$4.95
BK1001 Payroll With Cost Accounting — in BASIC — \$15.00
BK1009 PIMS: Personal Information Management System — \$9.95
BK1140 Programming in PASCAL — \$9.95
BK1005 Programming the 6502 — \$11.95
Scientific Research Instruments' BASIC Software Library
LB1002 Vol. I — \$24.95, LB1003 Vol. II — \$24.95, LB1004 Vol. III — \$39.95, LB1005 Vol. IV — \$9.95, LB1006 Vol. V — \$9.95, LB1007 Vol. VI — \$49.95, LB1008 Vol. VII — \$39.95.
The Secret Guide To Computers
BK1050 Part I — \$2.75; BK1051 Part II — \$2.50; BK1052 Part III — \$3.50
BK1006 6502 Applications Book — \$12.95
BK1075 6800 Software Gourmet Guide & Cookbook — \$10.95
BX1000 Shelf Box — 1 — \$2.00
BX1001 Shelf Box — 2 — \$1.50 each
BX1002 Shelf Box — 8 up — \$1.25 each
BK1053 Some Common BASIC Programs — \$9.50
BK1056 The Story of Computers — \$4.95
BK1063 TTL Cookbook — \$9.50
BK1064 TVT Cookbook — \$9.95
BK1071 What To Do After You Hit Return — \$10.95
BK1172 Your Home Computer — \$6.00



Solve your personal energy crisis. Let VisiCalc™ Power do the work.

With a calculator, pencil and paper you can spend hours planning, projecting, writing, estimating, calculating, revising, erasing and recalculating as you work toward a decision.

Or with VisiCalc and your Apple* II you can explore many more options with a fraction of the time and effort you've spent before.

VisiCalc is a new breed of problem-solving software. Unlike prepackaged software that forces you into a computerized straight jacket, VisiCalc adapts itself to any numerical problem you have. You enter numbers, alphabetic titles and formulas on your keyboard. VisiCalc organizes and displays this information on the screen. You don't have to spend your time programming.

Your energy is better spent using the results than getting them.

Say you're a business manager and want to project your annual sales. Using the calculator, pencil and paper method, you'd lay out 12 months across a sheet and fill in lines and columns of figures on products, outlets, salespeople, etc. You'd calculate by hand the subtotals and summary figures. Then you'd start revising, erasing and recalculating. With VisiCalc, you simply fill in the same figures on an electronic "sheet of paper" and let the computer do the work.

Once your first projection is complete, you're ready to use VisiCalc's unique, powerful recalculation feature. It lets you ask "What if?" examining new options and planning for contingencies. "What if" sales drop 20 percent in March? Just type in the sales figure. VisiCalc instantly updates all other figures affected by March sales.

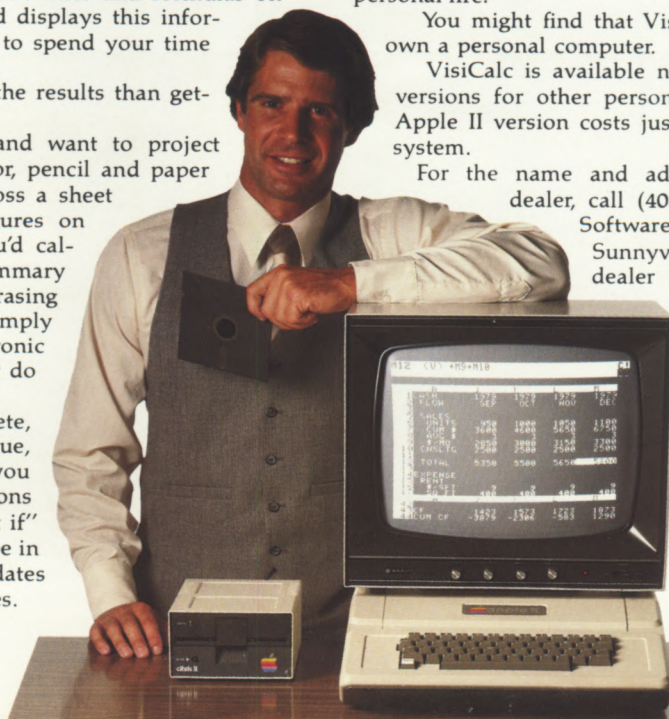
Or say you're an engineer working on a design problem and are wondering "What if that oscillation were damped by another 10 percent?" Or you're working on your family's expenses and wonder "What will happen to our entertainment budget if the heating bill goes up 15 percent this winter?" VisiCalc responds instantly to show you all the consequences of any change.

Once you see VisiCalc in action, you'll think of many more uses for its power. Ask your dealer for a demonstration and discover how VisiCalc can help you in your professional work and personal life.

You might find that VisiCalc alone is reason enough to own a personal computer.

VisiCalc is available now for Apple II computers with versions for other personal computers coming soon. The Apple II version costs just \$99.50 and requires a 32k disk system.

For the name and address of your nearest VisiCalc dealer, call (408) 745-7841 or write to Personal Software, Inc., Dept. K, 592 Weddell Dr., Sunnyvale, CA 94086. If your favorite dealer doesn't already carry Personal Software products, ask him to give us a call.

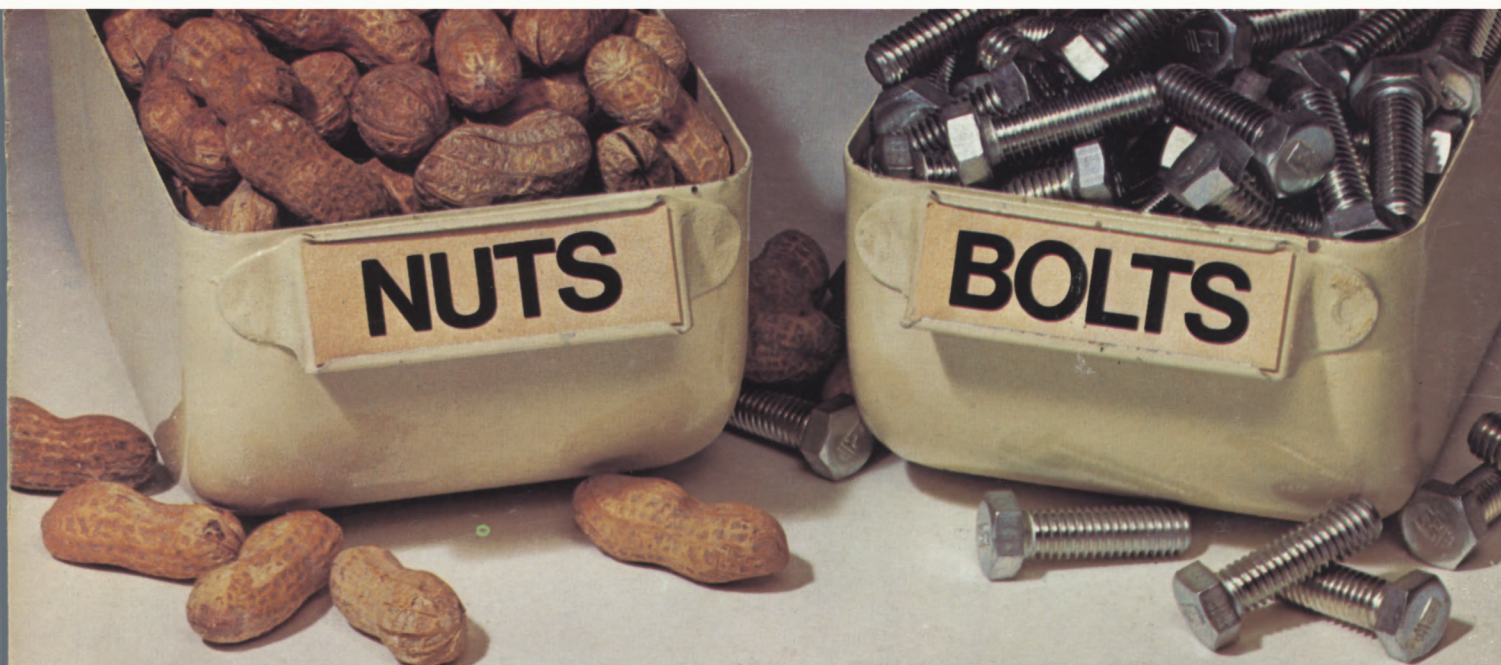


✓ P39
**PERSONAL
SOFTWARE**

VisiCalc was developed exclusively for Personal Software by Software Arts, Inc., Cambridge, Mass.

TM—VisiCalc is a trademark of Personal Software, Inc.

*Apple is a registered trademark of Apple Computer, Inc.



Inventory Problems?

Are you having trouble keeping the right nuts and bolts in stock? Since even a simple mistake can cost you time and money, a good inventory system should do more than just count parts. It should tell you exactly what you need, when you need it, where to get it, and how much it will cost.

The MSI Inventory System Seven enables you to maintain a versatile data base for controlling inventory. It lists part number, description, quantity on hand, vendor, cost, selling price, optional pricing, usage levels for previous month, present month, and year-to-date, and much more.

When quantity on hand items reach minimum levels, the System Seven compiles an automatic reorder list. This list can be generated by specific vendor as well as a complete listing of all materials to be ordered.

In addition to the item listing, the Inventory System Seven "bill of materials" provides you with a complete inventory of items used in the manufacture of subassemblies and complete products. It also contains other cost items such as labor costs, total raw materials costs, and miscellaneous costs.

The MSI Inventory System Seven is built around the versatile MSI 6800A Computer with 56K of RAM. An integral dual mini-floppy memory gives you an additional 630K of memory and makes

inventory control fast and efficient. The System Seven will interface with any industry standard CRT, and you have the option of both a "daisy wheel" word processor for high quality document preparation and a dot matrix printer for high speed production.

The System Seven can be expanded to handle all your data processing needs or you can select one of nine other MSI systems now available for business, industrial, scientific, educational, and personal applications.

If you need more than just a nuts and bolts inventory system, we have more information about how the Inventory System Seven can solve your problems economically.



MSI Inventory System Seven

MSI M70

Midwest Scientific

220 W. Cedar, Olathe, Kansas 66061, (913) 764-3273
TWX 910 749 6403 (MSI OLAT), TELEX 42525 (MSI A QLAT)